MAINTENANCE MANUAL

LABORATORIES INC.
1800 De la Cruz Ave. Santa Clara, CA 95050 (408) 727-3286

# CE-24A
# FREQUENCY SELECTIVE LEVELMETER

Cushman Electronics, Inc.

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APPLICABLE TO INSTRUMENTS
WITH SERIAL NUMBER 2381
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# MODEL CE-24A
# FREQUENCY SELECTIVE
# LEVELMETER

## MAINTENANCE MANUAL

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Electronics, Inc.

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[illegible] LABORATORIES
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470 Sapena St., #18
Santa Rosa, CA 95401

LABORATORIES
INC.
470 Cayetano Ct., #16
Santa Clara, CA 95050

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# SECTION 1
# THEORY OF OPERATION

## GENERAL

1.01 The following circuit descriptions are given to provide an understanding of the functioning of the electronics of the CE-24A Frequency Selective Levelmeter. Refer to the CE-24A Operation Manual for a description and use of the front panel controls and operating procedures. Instrument specifications are given in Table 1-1.

1.02 In the circuit descriptions, reference to discrete components is made through the use of a Circuit Reference Series. This series assigns numbers to the different circuit assemblies. The numbers are assigned as follows:

| Ckt. Ref. No. | Circuit Name |
|---|---|
| 1000 | Front Panel, Interconnections |
| 2000 | Main Chassis, Interconnections |
| 2100 | First L. O. |
| 2200 | RF Amplifier |
| 2300 | First IF Amplifier |
| 2400 | Second Mixer & Second L. O. |
| 2500 | Second IF & Gain Switch |
| 2600 | Audio/Meter Amplifier |
| 2700 | First Mixer |
| 3000 | Logic Container, Interconnections |
| 3100 | Logic |
| 3200 | LED Display |
| 4000 | Rear Panel |

The full reference to circuit components is made by combining the Circuit Reference Number, the component designation letter and the component number. For example, the first transistor in the RF Amplifier circuit will be Q2201, the third resistor, R2203, etc. When describing the individual circuits the component designations will be abbreviated, Q1, R3, etc., unless reference is made to a component in another circuit. In that case the full reference number will be given for that component.

## FUNCTIONAL DESCRIPTION

1.03 The CE-24A is a double conversion superheterodyne receiver. Its purpose is to measure the level and frequency of signals between 200 Hz and 5 MHz.

1.04 The signal to be measured is fed through the input attenuators and the RF Amplifier. The input may be set for either balanced or unbalanced lines and the connection may be either bridging or terminated.

1.05 In the first mixer the signal is converted to the 10.7 MHz first IF. The Local Oscillator (LO) includes a phase lock loop for stable frequency control and may also be connected to an Automatic Frequency Control (AFC) loop which holds the IF frequency in the center of the wide or narrow bandwidth filters.

1.06 A digital counter, programmed to read out the input frequency directly, counts the first LO frequency. This counter is referenced to a crystal controlled reference oscillator. Counter readout is an LED display.

1.07 The second mixer converts the signal to 2 kHz. The second LO functions both as the second LO and the carrier reinsertion oscillator for SSB demodulation.

1.08 The 2 kHz second IF passes through the wide or narrow bandwidth filters to a set of attenators that compensate for the Low Noise/Low Distortion settings and for the adjustments due to different line terminations. This makes it possible for the meter to be calibrated in dBm for any of the different input impedances and the Low Noise/Low Distortion modes.

1.09 The second IF Output is applied to a meter detector which drives the meter. The second IF also goes to an Audio Amplifier which drives the built-in speaker, or headphones when they are plugged in. The second IF is also connected to a phase detector, which receives its other input from the reference oscillator. The phase detector output is then used for the AFC loop.

1.10 An output from the 100 kHz reference oscillator is connected to the calibration amplifier to be switched to the input in the CAL mode. Thus both the level and the frequency of the CE-24A may be calibrated.

## CIRCUIT DESCRIPTION

1.11 RF Amplifier. 2200

1.12 Input to the RF Amplifier, Figure 3-5, comes through the input jacks, J1002, J1003, to the BAL/UNBAL Switch, S1007, Figure 3-1, to the IMPEDANCE Ω Switch, S2001, the TERM/BRDG Switch, S2002, Figure 3-2, and then to the inputs of the RF Amplifier.

1.13 The signal first passes through two 0 dB or 10 dB attenuators, one in each input channel. The series attenuators, R3, C2 and R18, C9 are

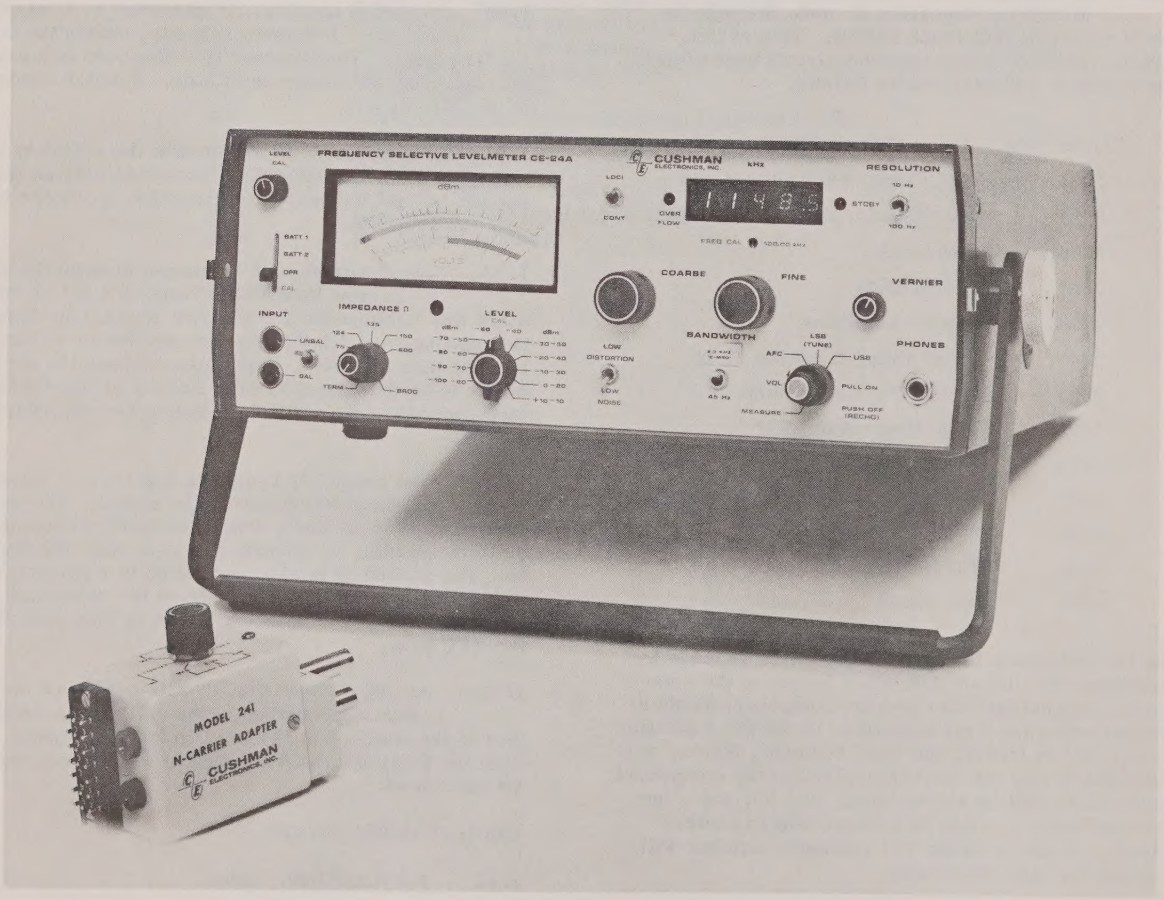



Figure 1-1. CE-24A Frequency Selective Levelmeter

TABLE 1-1. CE-24A SPECIFICATIONS

| ITEM | CHARACTERISTICS |
|---|---|
| FREQUENCY | |
| Range | .2-5000 kHz |
| Resolution | 10 Hz or 100 Hz, selectable |
| Accuracy | ±1 Count ±10 PPM |
| Display | LED, Continuous Tuning |
| LEVEL MEASUREMENT | |
| Range (Referred to zero dBm on Meter) | |
| Low Noise (.2-5000 kHz) | -80 to +10 dBm |
| Low Distortion (1-5000 kHz) | -100 to -10 dBm |
| Accuracy (Referred to zero dBm on Meter) | |
| 100 kHz at -40 dBm | ±.2 dB |
| Frequency Response | |
| 75Ω, 124Ω, 135Ω, 150Ω (Referred to 100 kHz) .2-5000 kHz | |
| 25°C ±10°C | ±.2 dB |
| 0°C to 55°C, Additional | ±.2 dB |
| 600Ω (Referred to 100 kHz) | |
| .2-650 kHz | ±.2 dB |
| Attenuator (Referred to -40 dBm) | ±.2 dB |
| Meter Range | -20 to +2 dBm |
| INPUT | |
| Impedance | |
| Unbalanced | 75, 124, 135, 150, 600, 10kΩ Shunted by Approx. 24pF |
| Balanced | 75, 124, 135, 150, 600, 20 kΩ Shunted by Approx. 12pF |
| Return Loss 75Ω | ≥ 30 dB |
| Common Mode Rejection (Balanced) | ≥35 dB |
| BANDWIDTH | |
| Wide | |
| 3 dB | 2.3 kHz |
| 60 dB | ≤ 5.1 kHz |
| Narrow | |
| 3 dB | 45 Hz |
| 60 dB | ≤ 450 Hz |
| Optional Wide | |
| 3 dB | 3.1 kHz |
| 60 dB | ≤ 6.5 kHz |

TABLE 1-1. CE-24A SPECIFICATIONS (Cont'.)

| ITEM | CHARACTERISTICS |
|---|---|
| INTERNAL DISTORTION ATTENUATION | |
| Low Distortion Mode (75Ω) | |
| Harmonic | |
| For 60 dB Sensitivity Increase (Fundamental ≤ 0 dBm) | ≥70 dB |
| Noise Power Ratio (Equivalent 600 Channel System with Stopband Slot at 2.438 MHz) | |
| For 40 dB Sensitivity Increase | ≥50 dB |
| INTERMEDIATE FREQUENCIES | |
| IF1 | 10.7 MHz |
| IF2 | 2 kHz |
| INTERNAL PHASE JITTER, Low Noise | 1°P-P Nominal |
| IF REJECTION | ≥70 dB |
| IMAGE REJECTION | ≥70 dB |
| OUTPUT (Nominal) | |
| Audio | |
| Speaker Power | 100mV |
| Phones Jack (Voltage into 600 ohms at 0 dB on meter) | 0V to >2V RMS |
| Distortion, at 0 dB on meter, 300 Hz to 3 kHz | ≤5% |
| Demodulation | LSB or USB |
| POWER | |
| AC | 50-400 Hz 115/230V ± 10% 14 Watt |
| Batteries | |
| Capacity | 2.3 AH (12V, 130mA Nominal)<br>6.3 AH (6V, 560mA Nominal) |
| Operating Time | 10 Hours Approx. |
| Recharge Time | 14 Hours Minimum at 25°C |
| DIMENSIONS | |
| Height | 5 1/4" (13.34 cm) |
| Width | 14" (35.56 cm) |
| Depth | 16" (40.64 cm) |
| WEIGHT | 25 lbs. (11.34 kg) |
| ENVIRONMENTAL | |
| Temperature, Operating | 0°C to +55°C |
| Storage | -40°C to +75°C |
| Humidity | 95% RH, 40°C |
| Shock | 10-55 CPS, .01" (.025 cm) p-p |
| Altitude, Operating | 25,000 ft. (7.62 km) |
| Non operating | 15,000 ft. (4.57 km) |

TABLE 1-2. 241 N Carrier Adapter Specifications

| ITEM | CHARACTERISTICS |
|---|---|
| EQUIPMENT COMPATIBILITY | CE-24, CE-24A |
| FREQUENCY RANGE | 1 kHz to 3.2 MHz |
| INSERTION LOSS (135Ω System) | |
| 1 kHz to 650 kHz | 0 dB |
| 650 kHz to 1 MHz | ≤ 0.1 dB |
| 1 MHz to 3.2 MHz | ≤ 0.2 dB |
| CROSS TALK (Between Adjacent Pairs Properly Terminated) | ≤ 40 dB to 1 MHz |
| INPUT CONNECTORS | |
| N-Carrier | W.E. 20 pin N-Carrier Type KS14160-L1 or Cinch 213-20-00-116 |
| Signal | 0.75 Inch Spaced Red and Black Banana Jacks |
| OUTPUT CONNECTORS | Dual W.E. 75Ω Coaxial, Trompeter PL2W |
| BREAKDOWN VOLTAGE | 300V DC Max. from any input to ground. |
| DIMENSIONS (Excluding W.E. Plugs) | |
| Height | 3.0" (7.62 cm) |
| Width | 2.1" (5.33 cm) |
| Length | 3.9" (9.91 cm) |
| WEIGHT | .5 lb. (.23 kg) Approx. |
| ENVIRONMENTAL | |
| Temperature, Operating | 0°C to 55°C |
| Temperature, Storage | -40°C to 75°C |
| Humidity | 95% R.H., +40°C |
| Vibration | 10-55 Hz 0.01" (.025 cm) Amplitude P-P. |
| Shock (W.E.) Connectors Protected) | 4 ft. Bench Drop |
| Altitude | |
| Operative | 15,000 ft. (4.57 km) |
| Non-operative | 25,000 ft. (7.62 km) |

switched in or out by FET switches Q1 and Q2. The shunt attenuators R5, R25 are switched out or in by FET switches, Q5, Q6. Transistors Q3, Q4 control the switches Q1, Q2.

1.14 10 dB attenuation is in the circuit, with switches Q1, Q2 open and switches Q5, Q6 closed, in all positions of the Attenuator switch, S2003, except -70, -80 dBm (-90, -100 dBm). In these low level settings the attenuation is switched to 0 dB.

1.15 Output from each attenuator goes to the Balanced-to-Unbalanced differential amplifier Q9, Q11, where the outputs are combined to provide a single ended output. (When the Input UNBAL mode is used the input to the BAL channel is grounded by the BAL/UNBAL switch, leaving the unused input jack open.) Q10 is a constant current source for Q9, Q11 to provide stable amplifier gain. Q15 buffers the output to the 0-70 dB attenuator switch, S2003. Q18 is a switch that turns off Q10 to disable the differential amplifier Q9, Q11 when the CE-24A is in the CAL mode, to prevent RF feedthrough from the input.

1.16 Also on this board is the Calibration amplifier and isolator. Input from the 100 kHz reference oscillator on the Logic board, 3100, is brought into the emitters of common base amplifiers, Q16, Q17, which provide a high degree of isolation. Output from the isolation amplifier is applied to the inputs of differential amplifier Q12, Q14, and the single ended output of Q12 is connected to the input of buffer amplifier, Q15. Q13 is a current source for Q12, Q14. R36 is an internal calibration level adjustment. The amplifier is turned off when not needed by connecting the base circuits of Q12, Q14 to ground through the CAL/OPR/BATT switch, S1001. CR7 provides temperature compensation for the base-emitter voltage of Q13.

1.17 The 70 dB attenuator, S2003, is mounted on the front panel, Figure 3-3, and is made up of a 10 dB, 20 dB and a 40 dB attenuator. These attenuators are switched in to give a total of 70 dB attenuation in 10 dB steps.

1.18 First IF Amplifier. 2300

1.19 Output from the 0-70 dB step attenuator enters this board through RF Amplifier, Q1, Q2, then passes through the 5 MHz low pass filter C7-C13, L3-L5 to the first mixer in the 2700 circuit enclosure. See Figure 3-6.

1.20 The 10.7 MHz first IF output from the First Mixer is amplified in the 1st IF Amplifier No. 1, Q4, Q5, then passes through the 10.7 MHz low pass filter, FL1, to the 1st IF Amplifier No. 2, Q3. Output from Q3 is coupled to the 1st IF Amplifier No. 3 on board 2400 through impedance matching Auto-transformer, T1.

1.21 First Mixer. 2700

1.22 The output of the 5 MHz low pass filter on board 2300 is connected to the center tap on the primary of mixer transformer, T2. See Figure 3-10. The 10.7-15.7 MHz L. O. enters the mixer through the low pass filter C1-C3, L1, L2 to the mixer transformer, T1. CR1-CR4, C4, C5, R1-R3 make up the remainder of the balanced mixer. Balance is adjusted for minimum LO feedthrough with C5 and R3. The 10.7 MHz output to the 1st IF Amplifier is taken from the secondary of T2.

1.23 Second Mixer and Second LO. 2400

1.24 The output of 1st IF Amplifier No. 2 enters this board through T1 and is amplified by common base 1st IF Amplifier No. 3, Q1. See Figure 3-7. Output from Q1 goes to the Second Mixer transformer, T2. The second LO frequency of 10.698 MHz or 10.702 MHz is generated by crystal oscillator Q5, Y1. The frequency is set by the bias on the varicap, CR6, by setting of R20. The LSB/USB switch either grounds or opens the circuit to pin 17, thus changing the oscillator frequency from 10.698 to 10.702. Oscillator output is amplified in emitter coupled pair Q6, Q7 and is then connected to the second mixer transformer, T3. The second LO functions as both an LO and a carrier reinsertion oscillator for SSB demodulation.

1.25 Output from the second mixer, taken from the center tap of mixer transformer, T2, goes to the second IF amplifier No. 1. Common base amplifier, Q2, provides isolation and further gain is provided by complementary pair Q3, Q4. Q8 is a current source for the amplifiers.

1.26 Second IF and Gain Switch. 2500

1.27 Amplified output from the second mixer enters board 2500 through pin 2 to either the 45 Hz filter or to the 20 dB amplifier, Q2, determined by the setting of the BANDWIDTH switch, S1004. In the 45 Hz BANDWIDTH setting Q2 is biased off by Q1 and Q5 is biased on by Q1, Q4 to connect the 45 Hz filter output to second IF Amplifier, IC1. Source follower, Q3, provides a high impedance termination for the filter. In the 2.3 kHz mode, Q2 is biased on and Q5 is biased off so that signal is routed through Q2 to the Second IF amplifier IC1. 20 dB gain through Q2 in the 2.3 kHz mode is necessary to compensate for the voltage gain through the 45 HZ filter (filter input impedance of 43.2Ω to the 294k Ω impedance at the input of the source follower, Q3). R6 is the calibrating adjustment to equalize the gain in both modes.

1.28 Output from the Second IF Amplifier, IC1, passes through the Signal to Noise Select Attenuator. Q8, Q9, Q10 are used to switch attenuation in or out in 10 dB steps as required in the LOW NOISE or LOW DISTORTION mode taking into account the settings of the Balanced 10 dB Attenuator and the RF Attenuator. The complete Attenuator switching pattern is given in Table 1-3. CAL and LOW NOISE switching through Q6 and Q7 override other settings as necessary.

Table 1-3. CE-24A ATTENUATOR AND IF GAIN SWITCHING

| Input Level | | Low Noise (LN) Mode | | | Low Distortion (LD) Mode | | |
|---|---|---|---|---|---|---|---|
| LN | LD | Balanced 10 dB Pad (2200) | RF ATTEN (S2003) | IF GAIN (2500) | Balanced 10 dB Pad (2200) | RF ATTEN (S2003) | IF GAIN (2500) |
| +10 | -10 | 10 dB | 70 dB | 0 dB | 10 dB | 70 dB | +20 dB |
| 0 | -20 | 10 | 60 | 0 | 10 | 60 | +20 |
| -10 | -30 | 10 | 50 | 0 | 10 | 50 | +20 |
| -20 | -40 | 10 | 40 | 0 | 10 | 40 | +20 |
| -30 | -50 | 10 | 30 | 0 | 10 | 30 | +20 |
| -40 | -60 | 10 | 20 | 0 | 10 | 20 | +20 |
| -50 | -70 | 10 | 10 | 0 | 10 | 10 | +20 |
| -60 | -80 | 10 | 0 | 0 | 10 | 0 | +20 |
| -70 | -90 | 0 | 0 | 0 | 0 | 0 | +20 |
| -80 | -100 | 0 | 0 | +10 | 0 | 0 | +30 |

1.29 The Impedance Select Amplifier isolates the S/N Select Attenuator from the following Impedance Select Attenuator. The settings of this attenuator, selected through switches Q11-Q14, adjust the level so that the meter will read correctly for the input impedance selected by the front panel switches.

1.30 Audio/Meter Amplifier. 2600

1.31 Input from the Second IF Gain switch through board pin B passes through a 7 kHz low pass R-C active filter. The output of Q1 drives IC1. The gain of IC1 is adjusted by the voltage variable resistance of Q4 which is adjusted with IC4, IC5, which in turn are controlled by the front panel LEVEL CAL control.

1.32 The signal from IC1 passes through board pin 16 to the front panel VOL control and back through board pin 17 to buffer, Q3, and then to the audio amplifier Op Amp IC3. Output then goes to the speaker and PHONE jack.

1.33 Output from IC1 also goes to the meter amplifier IC2 and rectifier CR1. The meter is in the feedback loop of IC2 to provide maximum linearity. Output from IC2 is rectified by Q2 and Q16. Q2 also provides current gain and R9, C11 smoothes the half sine wave to produce the DC RECORDER output through board pin 8.

1.34 An output from IC1 also goes to Q5. It operates as a saturated switch which squares up the signal and drives the one-shot IC6, C-D. The constant width pulse from the one-shot is applied to phase detector, IC7A, B. The other input to the phase detector is a 2 kHz output derived from the 100 kHz reference oscillator and is applied to the phase detector through the one-shot IC6A, B.

1.35 Output from the phase detector, IC7, CR12 and CR13 is applied to the AFC loop amplifier IC8 through R33. In the 2.3 kHz Bandwidth mode Q11 turns on. This shunts R33 with R34 to provide 20 dB additional gain required when operating this mode. Q7 provides a feedback path for the Loop Amplifier which causes the output of IC8 to be close to the voltage required by the Varicap, CR2114, to lock the loop when LSB or USB are selected. When AFC is selected, therefore, the loop is close to LOCK. This minimizes the time needed to acquire LOCK. Output from the loop amplifier goes to the vernier frequency varicap CR2114.

1.36 AC input from the power transformer is rectified by the 1N4002 diodes and regulated to the charging voltage of the -12V battery by zener diode, CR8, and series regulator, Q8. Output then goes to the battery through fuse F4003. Output also goes to the front panel off-on switch S1005 and then to the -10V regulator. CR9, R48, R47 and CR10 form an expanded scale voltmeter for monitoring the condition of BATT 2. Q9 protects the meter from overload when the battery is disconnected. Q10 forms a current source for CR10.

1.37 IC9 is the control amplifier that drives the series regulator, Q14. Voltage is adjusted with R59. Q15, R57 provide the short circuit protection. Q12 is a constant current generator and Q13 supplies the "B-" voltage and isolates the "B-" (about -10 volts) from the -10 volts which leave the board at pin K.

1.38 First L. O. 2100

1.39 The First L. O. frequency is generated by the VCO, Q24. The frequency is varied by the voltage applied to the varicap, CR13. In the LOCK/AFC mode the voltage applied to CR13 is the

summation of voltages from (1) the COARSE Frequency control, R1002, (2) the FINE Frequency control, R1003, through the VCO Steering Amplifier, Q13, Q14 and (3) the output of the VCO loop amplifier, IC2, which is determined by the phase detector output. The Harmonic Generator output frequencies are varied by the FINE control, R1003, the VERNIER control, R1004 (or the output of the AFC loop amplifier, IC2608, in AFC) through the Harmonic Generator driver. In the CONT mode the VCO loop amplifier output is clamped at a constant voltage so tuning is controlled only by the COARSE and FINE controls.

1.40 To provide good frequency stability the VCO is locked with the harmonics of the very stable 100 kHz Reference Oscillator through a phase detector and the VCO loop amplifier. The VCO locks on the 107th through the 157th harmonics of the 100 kHz reference. In order to provide continuous frequency coverage between the 100 kHz intervals, the 100 kHz Reference Oscillator is varied over a range of about -200 Hz to +1000 Hz by the FINE and VERNIER controls. When multiplied to the required harmonic numbers, this is a span of greater than 100 kHz, which more than covers the range between the lock points.

1.41 The frequency of the 100 kHz Reference oscillator is varied by the voltage applied to the varicap, CR6, by the FINE control, R1003, and by the voltage applied to the varicap, CR14, by the VERNIER control, R1004 and, when in the AFC mode, from the AFC loop amplifier, IC2608.

1.42 The high input impedance of FET amplifier, Q15, provides light loading for the output of the 100 kHz oscillator, Q11, Q12. Output from Q15 is amplified by the Harmonic Driver Q2-Q5 and applied to harmonic generator Q1, CR1. A wideband output load for Q1 is provided by transformers T1-T3 which emphasizes the higher order harmonics. This output is then applied to the phase detector CR2-CR5.

1.43 The frequency of the VCO is controlled by the voltage applied to the varicap, CR13 by the COARSE tuning, R1002, the VCO loop amplifier, IC2 and the VCO steering voltage from Q13, Q14 as noted before. Output from VCO, Q24, goes to the limiting circuit, Q19, Q20, which provides for a constant level output over the frequency range. Q20 drives the complementary emitter follower, Q21, Q22, which furnishes the output to the first mixer through isolation transformer, T4. Q19 drives the complementary emitter follower, Q16, Q17 which provides a low impedance output to drive the phase detector. L1, C13, C14 is a 16 MHz low pass filter to remove harmonics of the VCO frequency.

1.44 An output is taken from the junction of L1, C13 to the common base logic driver amplifier. The logic driver output is coupled out to the logic board, through isolation transformer, T5, where it is counted as the basis of the Frequency readout.

1.45 Output of the phase detector sampling gate, CR2-CR5, stores a charge on C20 to provide the control voltage. The output of C20 is buffered by Q8 and applied to the VCO loop amplifier IC2.

1.46 Control amplifier IC1, Q1 and series regulator Q6 provide regulated -10V for the First L.O. board. The reference voltage is taken from the output of the -10V regulator on the Audio/Meter board, 2600.

1.47 Logic. 3100

1.48 The prime purpose of the circuits on the Logic board is to take the output frequency of the first L.O. and, by means of a preset counter, generate a display that will read the frequency of the signal applied to the input of the CE-24A. The logic control circuits for the counter and the LED display, the 100 kHz crystal controlled Reference oscillator and the power supply and battery charger are also on this board.

1.49 The 100 kHz Reference Oscillator, Q1, Q2, Y1 (See Figure 3-12) is coupled out through a buffer inverter, IC1A, to provide a logic level output. CR3 provides temperature compensation for the oscillator. The output goes to the CAL Amplifier/Isolator on the RF board, through T1 and diode switch CR1, CR2. The output also goes to IC8B in the Period Select Synchronizer and to IC2 where it becomes the basic frequency for the Time Base Divider and the LED Display Multiplex circuits.

1.50 IC2 is a BCD divide-by-ten counter which drives the time base divider chain made up of IC5, IC7, IC8, each of which divide by ten and IC9A which divides by two to provide an output from IC9 of 5 Hz. Both the 5 Hz from IC9A and the 50 Hz output of IC8 are connected to Resolution control gate IC10A-D When +5V from the RESOLUTION switch, S3001, is applied to gate IC10 pins 10, 12, the 5 Hz signal passes through to the synchronizer, IC9B, providing 10 Hz resolution. When S3001 is set to 100 Hz RESOLUTION a ground level is applied to IC10 pins 10, 12 and 50 Hz passes to the synchronizer. The synchronizer is a J-K flip-flop connected so that the output follows the input on the occurrence of a clock pulse. The clock pulse is the 100 kHz reference frequency so the timing pulses are exactly synchronized. From the synchronizer the signal goes through inverter, IC4C, to the counter gate and preset circuits (Figure 3-13).

1.51 The BCD output of IC2 goes to the decimal decoder, IC3. The IC3 output is used to drive the Display Multiplexer Q9-Q12. The negative going count pulse out of IC3 turns on each transistor in sequence to enable the individual LED to read out the number stored in the segment decoder at that instant. This provides a LED duty cycle of 10% at a scanning rate of 10 kHz.

1.52 The decimal point light in the display is also controlled by the RESOLUTION switch through selection gates, Q5-Q7. A +5V applied to the gates selects 10 Hz Resolution and ground selects 100 Hz.

1.53 A 2 kHz signal from IC5 pins 11, 14 is inverted and applied to the optical coupler, IC6. This provides one signal to the phase detector

of the AFC control circuit on the Audio Meter board, 2600.

1.54 The 4 kHz output from IC5 pin 9 is buffered by IC1B, rectified by CR4, CR5 and the positive voltage level stored on C10. As long as the counter is counting, a positive voltage will appear on C10 which enables the 7 segment decoder IC27 (Figure 3-13) through IC1C, D. When no count is coming through IC5, C10 will lose its charge through R9 and the 7 segment decoder will be disabled, blanking the display. The display is also controlled by an input to IC1C pin 13 from the Counts Status Detector IC31 (Figure 3-13). When the counter displays a frequency <0 Hz the Status Detector enables a 5 Hz signal to IC1C pin 13 which causes the display to flash at a 5 Hz rate.

1.55 The 6V battery charger and 5V power supply are also on the Logic board. The output of the rectifier, CR6-CR9, is regulated by reference zener, CR12 and series regulator, Q3002. Charging voltage is adjusted with R23. The charging regulator output also goes to the 5 volt regulator, which is made up of control amplifier Q3, Q4, reference zener, CR11, and series regulator, Q3001. Voltage is adjusted with R26. R16, R17, R19 are the current overload resistors. When more than 1 amp flows, CR13 conducts, shutting off the series regulator, Q3001. R14, R18 are the scale adjusting resistors to the meter battery condition switch. CR10 provides overload protection for the meter.

1.56 The Time base output from the Period Select and Synchronizer inverter, IC4C, (H) (Figure 3-12) is connected to control circuits of the First L.O. Preset Counter (H) (Figure 3-13) to control the input gate and the preset and control circuits.

1.57 The L.O. frequency from the logic driver on board 2100 is coupled in through T2 and input amplifier, Q13. CR14 clips the negative pulses. The counter input gate, IC7A, is enabled by the Time base pulse for a period of 100 milliseconds in the 10 Hz Resolution mode or for 10 milliseconds for the 100 Hz Resolution mode; that is, the L.O. is counted for either 100 milliseconds or 10 milliseconds according to the RESOLUTION switch setting.

1.58 At the end of the count gate the negative going transition turns on the one-shot, IC17B, C which generates an approximately 0.7 microsecond negative pulse. This pulse is inverted in Q14 to provide a positive pulse to the enabling gates of storage registers IC12, 15, 19, 22, 25, and 28. The output of these registers is transferred to the multiplexing gates IC11, 14, 18, 21, and 24; to a Counter Status Detector input IC30, 31 and to IC27, a 7 segment decoder.

1.59 Output from Q14 also passes through coupling circuit C31, R46, R7 to provide an average level of +2.5V. The negative going part of the signal is inverted through IC17D to provide the positive preset pulse to the counters. This pulse is again inverted by Q15 to provide the Load pulse to the counters which load them to the preset count.

1.60 The preset pulse from IC17D always presets IC29 to 9 and IC16, 20 to 0. When the RESOLUTION switch is in the 10 Hz mode IC26 is preset to 3 and IC23 is preset to 0. In the 100 Hz RESOLUTION mode IC26 is preset to 9 and IC23 is preset to 3. Thus in the 10 Hz mode the counter is preset to 930000 and in the 100 Hz mode it is set to 993000.

1.61 When the counter gate is enabled the counter starts counting from the preset number and counts up to the maximum count and then starts over again from 000000 and counts up until the counter gate closes. The counter now has at its output, and stored in the storage register, the actual input frequency count.

1.62 As an example the input frequency is $F_{in}$ = 123.45 kHz and the RESOLUTION switch is set to 10 Hz. The L.O. frequency which is to be counted will be $F_{in} + F_{if} = F_{lo}$. 123.45 kHz + 10,700 kHz = 10823.45 kHz. Since the counter gate will be open for only 100 milliseconds (0.1 second) the number of cycles that will pass the gate will be 10823.45 kHz x 0.1 = 1082345 cycles. Since the counter starts counting from 930000, 70000 must be subtracted from this number of cycles. (1000000 - 930000 = 70000). 1082345 - 70000 = 1012345. Since the counter only displays five digits, only the number 123.45 will be seen with the decimal point properly placed by the RESOLUTION switch.

1.63 An example in the 100 Hz mode where the count gate is open for 10 ms (.01 sec) and the counter is preset to 993000. $F_{in}$ = 1234.50 kHz. $F_{lo}$ = 1234.50 + 10700. kHz = 11934.50 kHz. 1000000 - 993000 = 7000 and 11934.50 kHz x .01 = 119345 cycles. 119345 - 7000 = 112345 which when displayed will read 1234.5 kHz.

1.64 The count out of the counter at the end of the count gate is transferred to the storage registers IC12, 15, 19, 22, 24 where it is held until the next count transfer. The multiplexer gates IC11, 14, 18, 21, 24 are enabled, each in turn by the same pulse that enables the LED anodes, see paragraph 1.51. The count in each storage register is then decoded in the 7 segment decoder, IC27, and the output applied to the LED segment drivers Q16-Q22. The complementary count in the storage registers is used because the count is again complemented in the multiplex gates.

1.65 The segment drivers are parallel connected to the LED segments. However, since only one LED and its associated multiplex gate is enabled at any time, the proper numbers will appear in the display. Since the sampling repetition rate is so rapid the display appears to be continuous to the eye.

1.66 The counter status detector, made up of IC30, IC31 and inverter IC4D, controls the OVERFLOW light and the flashing display. The OVERFLOW comes on only in the 10 Hz mode when the frequency

is set to 1000.00 kHz or greater. The display flashes at a 5 Hz rate when an improper count total is displayed, for example Frequency 000.00 kHz.

1.67 IC30A senses the 1.000000 MHz or greater count in IC28 and turns on the OVERFLOW light through IC30B, IC30C. Whenever the Resolution mode switch is set to 100 Hz or the flashing display is operating IC30B inhibits the OVERFLOW. IC31A senses an improper count in IC25 and IC31B senses an improper count in IC28. Together with IC31C they enable IC31D to pass the 5 Hz signal to flash the display through IC1C, IC1D which control the 7 segment decoder.

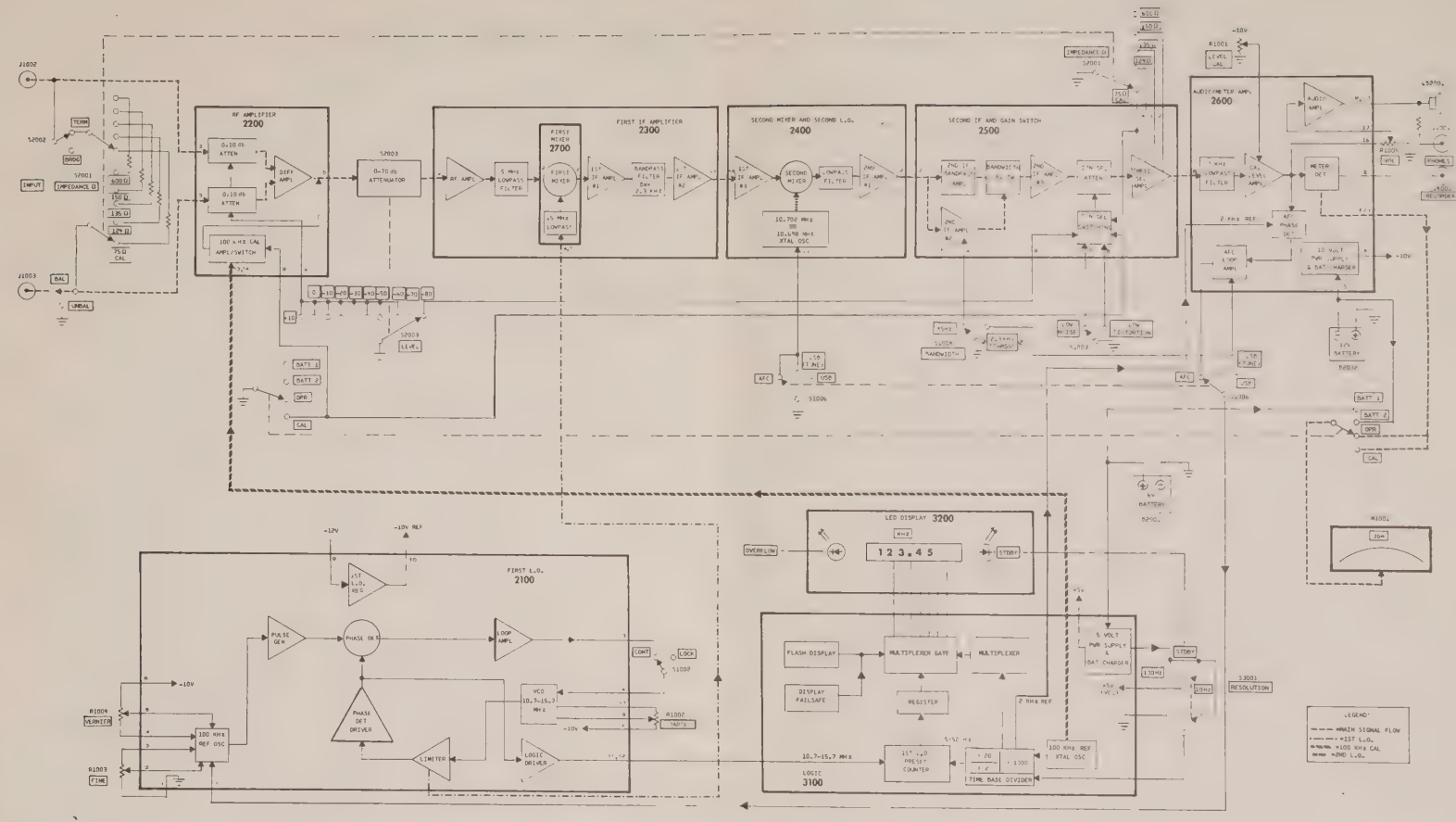
1.68 LED Display. 3200

1.69 The LED display is mounted on this board along with the OVERFLOW and the STANDBY indicators. When the RESOLUTION switch is placed in the center, STDBY, position, the +Vcc is removed from the LED display and the counter circuits and the STDBY light comes on. Since the LED's and counter place the heaviest load on the battery, the battery charge may be conserved by keeping the switch in STDBY whenever frequency readings are not being taken. This applies to battery operation in field use.

1.70 N-Carrier Adapter.

1.71 The N-Carrier Adapter is a plug-in accessory to the CE-24A or the CE-24. It is equipped with coaxial plugs to fit the CE-24A input. It has a WE20 connector which mates with a WE20C interconnecting cord to connect to N-Carrier repeaters or terminals. It also has a set of banana jacks through which level measurements may be made while the adapter is still connected to the CE-24A and the N-Carrier equipment.

1.72 A rotary switch selects the circuits to be measured in the N-Carrier equipment. When placed in the INPUT position the banana jacks are connected to the CE-24A input and all the other circuits are disconnected. In the OFF position all the input circuits are disconnected and the input to the CE-24A is shorted.




5661-0053

Figure 1-2. CE-24A Block Diagram

# SECTION 2
# MAINTENANCE

## GENERAL

2.01 This section provides the information necessary to maintain the Cushman CE-24A in proper operating condition. The Performance Check may be used for incoming inspection or for determining whether or not the instrument is in need of calibration. The CE-24A may be recalibrated as necessary using the Calibration and Adjustment procedures given.

2.02 If the Calibration and Adjustment procedures do not correct the trouble and if the cause of the problem is not apparent or readily repairable, it is recommended that the Cushman Electronics Customer Service Department be contacted for further information or to make arrangements to ship the instrument to the factory or a service center for repair.

## PREPARATION FOR RESHIPMENT

2.03 It is recommended that the shipping box and foam packaging be kept in case it becomes necessary to return the instrument to the factory or service center for service or repair.

2.04 The following paragraphs contain a general guide for repackaging of the instrument for shipment.

1. Attach a tag to the instrument identifying the owner, and indicate the service or repair to be made. Include the model number and full serial number of the instrument. In any correspondence, identify the instrument by model and serial number.

2. Place the instrument in the original container. Make certain that the container is well sealed with strong tape.

3. If the original container is not used, wrap the instrument in plastic or heavy paper before placing in an inner container.

4. Place packing material around all sides of the instrument.

5. Place the instrument and inner container in a heavy carton and seal with strong tape.

6. Mark the shipping container: "DELICATE ELECTRONIC INSTRUMENT", "FRAGILE".

NOTE

Both of the battery connectors must be disconnected before shipping the CE-24A.

## SERVICE OR REPAIR

2.05 In the event that service or repair is required, contact:

Cushman Electronics, Inc.
Customer Service Department
2450 N. First Street
San Jose, California 95131
Telephone: (408) 263-8100
TWX: 910-338-0556

2.06 Cushman Electronics repair service is also available at the following service centers:

Reshal Associates, Inc.
219 West University Drive
Arlington Heights, Illinois 60004
Telephone: (312) 398-7660
TWX: 910-687-2824

Tele-Radio Systems, Ltd.
301 Supertest Road
Downsview P.O.
Toronto, Ontario, Canada M3J 2M4
Telephone: (416) 661-3221
TWX: 610-492-2384

Tele-Radio Systems, Ltd.
11567 160th Street
Edmonton, Alberta, Canada T5M 3V9
Telephone: (403) 451-2143
TWX: 610-831-2896

## PERFORMANCE CHECK

2.07 The equipment listed below or the equivalent may be used:

| | |
|---|---|
| Signal Generator | CE-26A |
| Frequency Counter | Dana 8020 |
| 40 dB Fixed Attenuator | Texscan FP-75 |

2.08 Set the CE-24A controls as listed below. This is the basic setup. Any changes will be indicated in the various steps.

| | |
|---|---|
| AC Power Cord | Connected to AC line |
| BATT/OPR/CAL | OPR |
| INPUT | UNBAL |
| IMPEDANCE | 75Ω, TERM |
| LEVEL | -40 dBm (Blue) CAL |
| NOISE-DISTORTION | LOW NOISE |
| BANDWIDTH | 2.3 kHz |
| AFC/LSB/USB | LSB (Tune) |
| VOL | MEASURE |
| AC SWITCH | PUSH OFF |
| LOCK/CONT | LOCK |
| RESOLUTION | 10 Hz |
| FREQUENCY | 101.00 kHz |

2.09 Preparation for Performance Checks

a. The batteries should be fully charged before conducting any of the performance checks. Connect the CE-24A to the AC power source and push in the Power switch on the front panel to the off position. Leave on charge for at least 14 hours.

2.10 Turn on the CE-24A by pulling out VOL control knob. Allow the instrument to warm up for a short time before performing any of the tests. Do not remove covers.

2.11 Cal Level Check

a. Set CE-26A to 101.00 kHz and 0.0 dBm 75Ω. Connect to CE-24A.

b. Set CE-24A BATT/OPR/CAL switch to OPR and tune CE-24A to 101.00 kHz. Switch AFC/LSB/USB switch to AFC.

c. Check that CE-24A acquires and holds the CE-26A signal and that the CE-24A level reads 0.0 dB ± 0.1 dB.

2.12 Frequency Cal Range

a. Leave controls set as in previous step.

b. Using a non-metallic screwdriver, check that the FREQ CAL range will go from less than 100.35 kHz to greater than 101.35 kHz.

c. Set BANDWIDTH switch to 45 Hz.

d. Adjust FREQ CAL for 100.00 kHz.

2.13 Frequency Range

a. Set RESOLUTION to 100 Hz. Set to LSB (Tune).

b. Tune COARSE control for maximum frequency. Should read at least 5.5 MHz.

c. Tune COARSE control for minimum frequency. Should read a flashing display of 9600.0 or less (-400 kHz).

d. Set FINE control to maximum CCW position and set COARSE control for a reading of 80 kHz ± 5 kHz. Note frequency.

e. Tune FINE control maximum CW. Frequency should read ≥210 kHz.

f. Check that VERNIER control has a range of approximately 200 Hz.

2.14 Attenuator Check

a. Set CE-26A to 100 kHz and leave it connected to the CE-24A. Set CE-24A BANDWIDTH to 45 Hz and carefully tune for maximum meter reading. Use CAL Level control to set meter to 0.0 dB. Switch to AFC.

b. Check LEVEL in 10 dB steps from +10 dBm to -80 dBm in LOW NOISE (blue figures), with CE-26A. Use fixed attenuators to extend range of CE-26A. CE-24A meter should read 0.0 dB ± 0.2 dB at each step, taking into account any fixed attenuator error.

c. In the same manner as above check the LEVEL in 10 dB steps from -10 dBm to -100 dBm in LOW DISTORTION (black figures) with the CE-26A. Use fixed attenuators to extend range of CE-26A. CE-24A meter should read 0.0 dB ± 0.2 dB at each step.

2.15 Frequency Response

a. Set the CE-26A and the CE-24A to -40 dBm. Set CE-24A to LOW NOISE and set meter to 0.0 dB using CAL control. Both instruments are still set to 100 kHz.

b. Set both instruments to 2 MHz. Check that CE-24A meter reads 0.0 dB ±0.2 dB.

c. Set both instruments to 4 MHz. Check that CE-24A meter reads 0.0 dB ±0.2 dB.

d. Set both instruments to 5 MHz. Check that CE-24A meter reads 0.0 dB ±0.2dB. Disconnect CE-26A.

2.16 Power Supply

a. Set BATT/OPR/CAL switch to CAL, FREQUENCY to 100.00 kHz.

b. Tune for maximum indication on the meter and adjust LEVEL/CAL control for 0.0 dB on the meter.

c. Switch to 45 Hz BANDWIDTH and very carefully tune for maximum meter indication. Meter should read 0.0 dB ± 0.1 dB. Note frequency and level.

d. Unplug the line cord and check that there is no change in LEVEL from the frequency noted above.

e. Switch to BATT 1 and BATT 2. The meter should read above 0.65 on the 1.0 volt scale.

f. Reconnect AC cord to line.

2.17 Audio Output

a. Set controls as in paragraph 2.16 except set BANDWIDTH switch to 2.3 kHz.

b. Turn volume control fully clockwise. A high pitched tone should be heard. Turn VOL back to MEASURE.

2.18 Miscellaneous Checks

a. Set RESOLUTION switch to STDBY. Check that STDBY light comes on.

b. Check that decimal point lights properly in both 10 Hz and 100 Hz RESOLUTION positions.

c. Set RESOLUTION switch to 10 Hz. Tune COARSE for 1 MHz. Check that overflow light comes on.

d. Set LOCK/CONT switch to CONT. Check that COARSE tunes continuously over the full range. Set LOCK/CONT switch back to LOCK.

ADJUSTMENT PROCEDURE

2.19 Preparation for Adjustment

a. The batteries should be fully charged before beginning adjustment procedures. Connect the CE-24A to the AC power source and push in the Power switch on the front panel to the OFF position. Leave on charge for at least 14 hours.

b. Remove top and bottom covers. Remove shield cover over the 3100, 3200 circuit boards.

**CAUTION**

Whenever removing or replacing a circuit board be sure to remove the battery fuses and disconnect the line cord. Power supply checks must be made with the batteries connected. For the remainder of tests the unit may be operated on AC with the battery fuses removed.

c. The following test equipment, or the equivalent, is required:

| | |
|---|---|
| Signal Generator | CE-26A |
| Frequency Selective Levelmeter | CE-21A or CE-24A |
| DVM | Dana 4700 |
| AC VTVM | HP 400FL |
| Frequency Counter | Dana 8020 |
| (2) 20 dB Fixed Attenuators | Texscan FP-75 |

d. Set the CE-24A controls as listed below:

| | |
|---|---|
| BATT/OPR/CAL | CAL |
| INPUT | UNBAL |
| IMPEDANCE | 75Ω, TERM |
| LEVEL | CAL (-40 dBm, Blue) |
| NOISE/DISTORTION | LOW NOISE |
| BANDWIDTH | 2.3 kHz |
| AFC/LSB/USB | LSB (Tune) |
| VOL | MEASURE |
| AC SWITCH | PULL ON |
| LOCK/CONT | LOCK |
| RESOLUTION | 10 Hz |
| FREQUENCY | 100.00 kHz |
| AC CORD | To AC supply |

2.20 Power Supply Adjustment

a. Remove both battery fuses. Raise the 2600 board on the extender board. (Board numbers are stamped on bottom of board pocket.) See Figure 2-1.

b. Connect DVM to pin 1, J7, on board 3100. Set RESOLUTION switch to STDBY. Turn on CE-24A. Adjust R3123 for +7.2V ± .05V. See component identification drawing, Figure 3-12, for jack and adjustment control locations.

c. Connect DVM to pin 1, J8, on board 3100. Adjust R3126 for +5.1V ± .05V. Repeat steps b. and c. until no further adjustments are necessary.

d. Set RESOLUTION switch to 10 Hz and set FREQUENCY to 888.88 kHz. Voltage at pin 1, J8, should be between +4.85 and +5.10V DC.

e. Turn off CE-24A. Connect DVM to lower end of R2646 (two 10Ω resistors in parallel). Voltage should read 14.40V ± .05V. Adjust R2644 for this voltage if necessary.

f. Connect DVM to pin k on 2600 board. Turn on CE-24A and allow voltage to stabilize. Adjust R2659 for -10.000V DC ± .001V. Turn off CE-24A, reinstall 2600 board and battery fuses in CE-24A.

g. Turn on CE-24A. Disconnect AC power cord from AC source. Set BATT/OPR/CAL to BATT 1 and then to BATT 2. Both should read in the blue area on the meter. A fully charged battery should read approximately 0.75V on the 1V scale. Reconnect AC power and remove battery fuses for remainder of test if desired. Be sure to observe CAUTION of 2.19 b. if fuses are left in circuit.

2.21 First L.O. Frequency Range Adjustment. 2100

a. Raise 2100 board on extender.

b. Set controls as in paragraph 2.19 d. except set RESOLUTION to 100 Hz. Turn the COARSE tuning control from max CCW to max CW and note frequency range. Range should be at least from -400 kHz to 5500 kHz. (-400 kHz is a flashing display of 9600.00 kHz). Adjust L11 if necessary to obtain this range.

c. Set COARSE control to approximately 100.00 kHz.

d. Tune FINE control from max CCW to max CW. Range should be approximately from 80 kHz to 210 kHz. (COARSE control may have to be retuned to bring FINE control into proper range). If necessary adjust R52 to give a total range of 130 kHz ± 500 Hz.

e. Set COARSE and FINE controls for a frequency of 100 kHz. Set RESOLUTION to 10 Hz. Adjust VERNIER control from max to min. Range should be 200 Hz ± 50 Hz.

2.22 100 kHz Oscillator. 2100

a. Set controls as in 2.19 d. Using a X10 probe, connect the oscilloscope to the junction of L6 and C37. Should display a sine wave greater than 8V p-p with a period of 10 μsec. Disconnect oscilloscope.

b. Set FINE control fully CCW. (RESOLUTION still set to 10 Hz.)

c. Adjust COARSE control. Frequency should change in 100 kHz steps ± .1 kHz. If increments are much greater, screw in the adjustment of L6 to change the frequency by 100 kHz and recheck tuning. If further adjustment is necessary adjust L6 either in or out for a frequency change of 100 kHz until minimum variation from 100 kHz steps is noted as the COARSE control is tuned.

d. Set COARSE control for 80 kHz. Tune FINE for a frequency of 100 kHz. Tune COARSE control. Frequency should change in 100 kHz steps ± .1 kHz.

e. Check FINE range. Should be from 80 kHz to 214 kHz ± 5 kHz.

f. Replace 2100 board in CE-24A.

2.23 Second LO Frequency Adjustment. 2400

a. Set controls as in 2.19 d. and elevate 2400 board on extender.

b. Connect X1 scope probe to TP1 and adjust L7 for maximum amplitude.

c. Set AFC/LSB/USB switch to LSB. Connect counter to TP1. Set counter Time Base to 100 msec.

d. Adjust L5 for a counter reading of 10.69800 MHz ± 20 Hz. (If signal tends to drop out before correct frequency is reached, back up on adjustment and go to the following step.)

e. Set AFC/LSB/USB to USB. Adjust R20 for 10.70200 MHz ± 20 Hz. Alternate between steps c. and d. until the correct frequencies are reached. Should converge rapidly.

f. Connect oscilloscope to TP1. Waveform should be greater than 0.9V P-P. Replace 2400 board.

2.24 Counter Calibration

a. Set controls as in 2.19 d.

b. Tune for a maximum indication on the meter. Switch to AFC. Check that AFC is working by slightly adjusting FINE control and noting that there is no change in Frequency reading.

c. With a non-metallic tool adjust Frequency reading for 100.00 kHz.

2.25 First Mixer Balance. 2700

a. Set controls as in 2.19 d., except set BATT/OPR/CAL switch to OPR. Shield cover must be over 2700 board with adjustment toward front. Tune Frequency to 0000.00 kHz. If meter goes off-scale, tune for an on-scale reading and start adjustment as given in next step.

b. Alternately adjust the two Mixer Bal controls (C5, R3) for minimum meter reading. A reading of less than -5 dB on the meter scale at 0000.00 kHz should be obtained.

2.26 Second IF Gain Adjustment. 2500

a. Set controls as in 2.19 d. Elevate 2500 board on the extender.

b. Set CAL LEVEL control to mid-range and tune for maximum meter indication.

c. Set AFC/LSB/USB switch to AFC. Adjust R18 for zero dB on the meter.

NOTE: Steps d-h should be performed only if the 45 Hz filter is known to be out of spec.

d. Set BANDWIDTH to 45 Hz. Connect AC VTVM to TP1.

e. Adjust L1 for a null. Adjust L2 for a peak. Adjust L3 for a null. Adjust in this order and repeat two times. Note level.

f. Now adjust L2 for a peak reading. Note difference between this reading and the one taken in the previous step.

g. Adjust L2 in the opposite direction to the level noted in e. plus 1/2 the difference noted in f. Then adjust both L1 and L3 for a null.

h. Repeat e. through g. until the lowest null is obtained in step g.

i. Adjust R6 for a zero dB reading on the CE-24A meter. Replace 2500 board in CE-24A.

2.27 CAL Source Calibration

a. Set the CE-24A controls as in 2.19 d., except set BATT/OPR/CAL switch to OPR. Set LEVEL CAL control to mid-range.

b. Set CE-26A to 100.10 kHz, 75Ω and connect the UNBAL input of CE-24A.

c. Tune for maximum reading on the CE-24A and adjust R2518 for a zero dB reading on the CE-24A.

d. Disconnect CE-26A from CE-24A. Set BATT/OPR/CAL switch to CAL, and tune to 100.00 kHz. Adjust R2236 for a zero dB reading on the CE-24A meter.

e. Switch RESOLUTION to STDBY. Meter should still read 0.00 dB ± 0.03 dB. If not, adjust L3101 until there is no variation between the readings.

f. Connect DVM to RECORDER output on CE-24A rear panel. Tune for zero dB in CAL mode. DVM should read -1.0V ± .05V. Adjust R2608 for this reading.

2.28 CMR Adjustment and Frequency Response

a. Set the CE-24A as in 2.19 d., except set BATT/OPR/CAL to OPR and set LEVEL to -70 dBm. Set CE-26A to -70 dBm (use fixed 20 dB attenuator) and connect to UNBAL input of CE-24A. Adjust CAL LEVEL control for 0.0 dB on meter.

b. Set CE-24A and CE-26A to 5 MHz. Adjust C2205 for -0.1 dB ± .05 dB on meter. (If this setting cannot be achieved the Low Pass Filter on First IF Amplifier board is misadjusted.) (See paragraph 2.30).

c. Set CE-24A and CE-26A to -60 dBm at 100 kHz and set CAL LEVEL control for 0.0 dB on the meter.

d. Set CE-24A and CE-26A to 5 MHz. Adjust C2203 for -0.1 dB on meter.

e. Set CE-26A to -36 dBm. Attach BNC Tee to CE-26A and connect two equal lengths of 75Ω coax to Tee and connect other ends to BAL input on CE-24A. Set INPUT to BAL. Adjust C2211 for a minimum meter reading. Reading should be less than -65 dBm. Remove BNC Tee and two cables. Repeat steps b. through e.

f. With CE-26A connected to the CE-24A UNBAL input, set the CE-26A to -50 dBm at 100 kHz. Adjust CE-24A LEVEL CAL control for 0.0 dB on the meter.

g. Set both CE-26A and CE-24A to 5 MHz. Adjust C2004 (adjustment nearest front panel under front end of instrument, accessible through the attenuator shield) for -0.1 dB on the meter.

h. Set both the CE-26A and CE-24A to -30 dBm at 100 kHz. Adjust LEVEL CAL control for 0.0 dB on the meter.

i. Set both the CE-26A and CE-24A to 5 MHz and adjust C2005 (rear adjustment accessible through attenuator shield) for -0.1 dB on the meter.

2.29 45 Hz Bandpass Filter Test and Equalization

a. Set the CE-24A controls as in paragraph 2.19 d. except set BANDWIDTH to 45 Hz, LOW NOISE/DISTORTION to LOW DISTORTION, LEVEL to -10 dBm and BATT/OPR/CAL to OPR.

b. Put covers on instrument and allow it to warm up for at least one hour.

c. Set the CE-26A to 100 kHz and connect to the UNBAL input of the CE-24A. Check for a bandwidth of 45 Hz ± 5 Hz by adjusting the FINE control and observing the frequency on the CE-24A.

d. Set CE-24A to -60 dBm and check 60 dB bandwidth for 450 Hz.

e. Remove CE-26A. Set CE-24A BANDWIDTH to 2.3 kHz and set AFC/LSB/USB to AFC. Adjust LEVEL CAL control for 0.0 dB on the meter.

f. Switch BANDWIDTH to 45 Hz and adjust R2506 for 0.00 dB on the meter.

2.30 First Mixer Low Pass Filter Adjustment

a. Special equipment is required for this adjustment. It should not be attempted unless the proper equipment is available.

b. Equipment required (or equivalent):

| | |
|---|---|
| Spectrum Analyzer | HP 8553B |
| Level Meter of Signal Generator - TTS | Siemens 2021 |

c. Set controls as in 2.19 d., except set Frequency to 4192.5 kHz and BATT/OPR/CAL switch to OPR. No signal connected to INPUT.

d. Elevate board 2300 on the extender. Remove shield from First Mixer (mounted on 2300 board) by removing 2 flat head screws.

e. Use a minimum of 40 dB in the Spectrum Analyzer RF Attenuator. Connect input of Spectrum Analyzer to TP2701 (on the First Mixer), using RG55 coax cable with alligator clips.

f. Set Spectrum Analyzer so that 29.785 MHz (second harmonic of the first LO) is in the center of the screen. Then adjust L2701 (in Mixer) for a minimum level. Should be less than -40 dB with respect to First LO. Disconnect Spectrum Analyzer from TP2701. Replace shield on mixer.

2.31 Low Pass Filter Alignment

a. With the CE-24A set up as in the previous step connect Signal Generator to INPUT, 75Ω, UNBAL. Set Signal Generator to 0 dBm at 10.7 MHz. Signal Generator and Levelmeter to be connected together as a TTS system.

b. Remove jumper between TP3 and TP6 (on 2300 board) and connect Levelmeter to TP6, using RG55 cable and alligator clips. Connect shield to ground plane on the board.

c. Set CE-24A Frequency to 5000.0 kHz, LEVEL to -90 dBm, LOW DISTORTION/LOW NOISE to LOW DISTORTION and AFC/LSB/USB to AFC.

d. Set L3, L4, L5 to minimum inductance (slugs out slightly through bottom of board).

e. Adjust L4 for a minimum reading. Should be at least 80 dB below the input level.

f. Set Signal Generator to 13.033 MHz. Adjust L5 for a minimum reading. Should be at least 80 dB below the input level.

g. Set the Signal Generator and the CE-24A to -90 dBm at 5000.0 kHz. Replace jumper between TP3 and TP6 and adjust L3 for a maximum reading on the CE-24A meter. Remove test equipment and replace 2300 board in CE-24A.

TROUBLESHOOTING

2.32 A list of front panel indications of trouble and their possible causes is given below to aid in localizing trouble to a particular area of the instrument. For further aid in troubleshooting, perform the adjustment procedure while studying the theory of operation applying to that section of the instrument. This will aid in localizing the trouble to some part of a board. Suspected components can then be checked and substituted to clear the trouble.

2.33 If these procedures fail to produce proper results, call Cushman Electronics, Inc. Customer Service Department at the address listed in paragraph 2.05 for further information or to make arrangements to ship the instrument to the factory or a service center for repair.

Table 2-1. Troubleshooting Chart

| INDICATED TROUBLE | POSSIBLE CAUSE |
|---|---|
| No meter reading in BATT positions. (Not connected to AC source) | Instrument not turned on. Batteries not connected. Fuse blown. |
| Meter reading low in BATT positions after 12 hour charging cycle. (Not connected to AC source) | AC fuse blown so not charging when connected to AC. Defective Batteries. Trouble in AC power supply circuits. |
| BATT indications ok but no Frequency display. | RESOLUTION switch in STDBY. |
| Will not hold Frequency in AFC | AFC Phase Detector or Loop Amplifier on 2600 board. |
| Unable to CAL<br>Receive ok | 100 kHz CAL AMPL/SWITCH board 2200 |
| Unable to calibrate or receive | Power Supply, RF Ampl. board, First Ampl. Second Mixer and Second L.O., Second I.F., Audio/Meter Ampl. |
| Receive ok but improper Frequency display | Logic board, 3100, or First LO board, 2100 |
| Receive ok but no Audio | Audio Amplifier on 2600 board. Speaker open. |
| Improper or no readings in one or more impedance switch positions. | Defective resistor or open connection in impedance selector circuits. |
| Improper or no readings in some positions of the level switch | Defective resistor or open connection in attenuator circuits. |

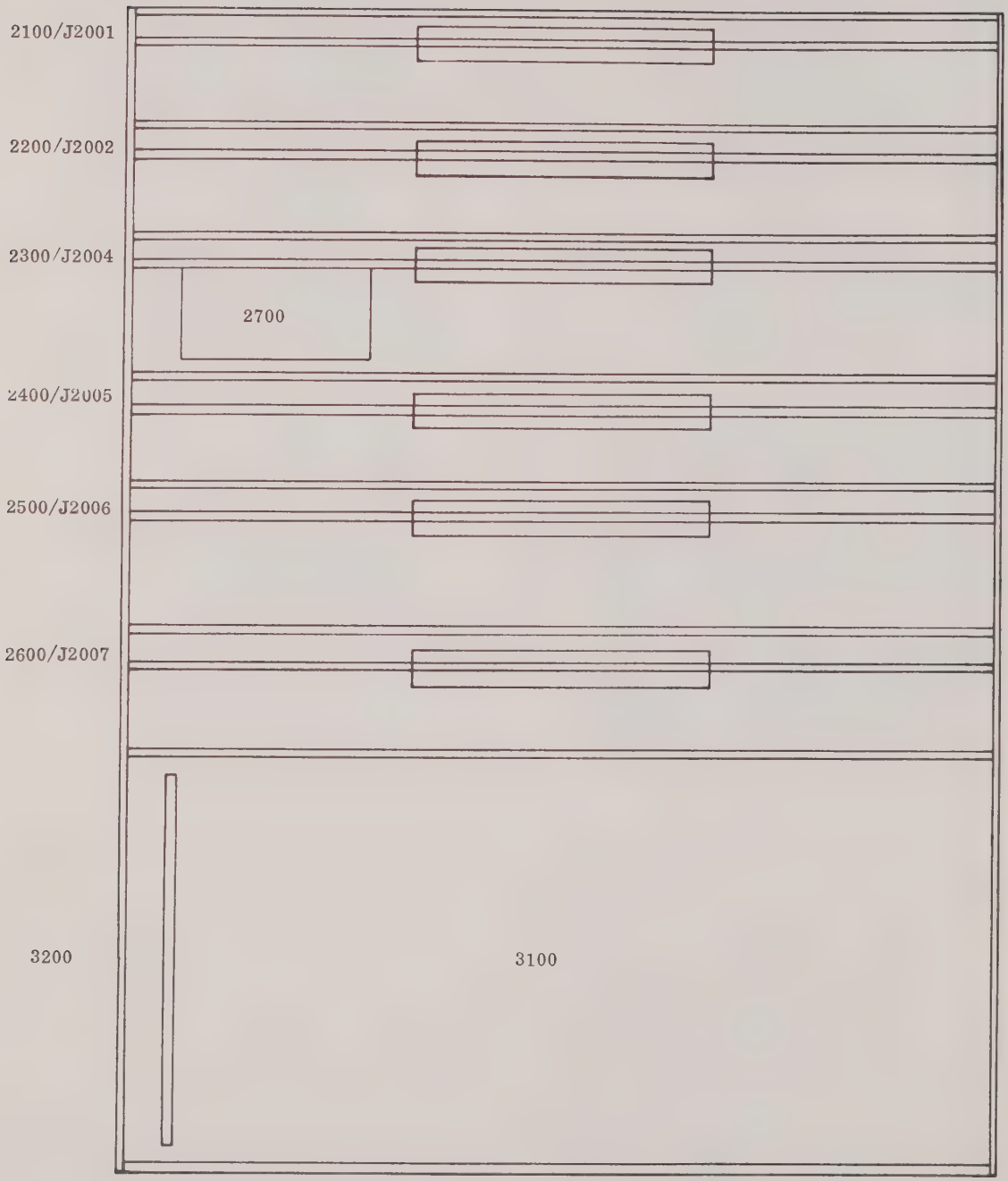



Figure 2-1. CE-24A Circuit Board Location

# SECTION 3

# PARTS LISTS AND SCHEMATIC DIAGRAMS

INTRODUCTION

3.01 The following parts list and schematic diagrams have been arranged in order accordingly to the Circuit Reference Series numbers. Refer to paragraph 1.02. Each parts list and schematic diagram is identified with this number. The circuit boards in the instrument are stamped with an identifying circuit board number. See Cross Reference Table 3-1 below.

3.02 Parts list pages are grouped with the schematic diagrams to which they refer. Component identification drawings showing the location of the individual components on the circuit boards are placed in the inner sheet of the schematic diagram to which they apply.

Table 3-1. Printed Circuit Board and Circuit Reference Numbers Cross Reference

| Ckt. Bd. No. | Circuit Title | Ckt. Ref. No. | Assembly No. | Figure No. |
|---|---|---|---|---|
| 1780-0475 | R.F. Amplifier | 2200 | 7001-0247 | 3-5 |
| 1780-0746 | 1st I.F. Amplifier | 2300 | 7001-0248 | 3-6 |
| 1780-0477 | 2nd Mixer and 2nd L.O. | 2400 | 7001-0249 | 3-7 |
| 1780-0478 | 2nd I.F. and Gain Switch | 2500 | 7001-0250 | 3-8 |
| 1780-0479 | Audio/Meter Amplifier | 2600 | 7001-0251 | 3-9 |
| 1780-0480 | 1st L.O. | 2100 | 7001-0246 | 3-4 |
| 1780-0481 | L.E.D. Display | 3200 | 7001-0453 | 3-14 |
| 1780-0482 | Logic | 3100 | 7001-0452 | 3-12/13 |
| 1780-0483 | P.C. Board Extender | 0000 | 7001-0254 | ---- |
| 1780-0484 | 1st Mixer | 2700 | 7001-0256 | 3-10 |
| --------- | Front Panel | 1000 | 7003-0084 | 3-1 |
| --------- | Main Chassis | 2000 | --------- | 3-2/3 |
| --------- | Logic/Display Container Assy | 3000 | 7046-0022 | 3-11 |
| --------- | Rear Panel | 4000 | 7003-0085 | 3-15 |
| --------- | N-Carrier Adapter | ---- | --------- | 3-16 |

FRONT PANEL. 1000

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 1000 | Front Panel Assembly | 7003-0084 | Cushman | |
| | CONNECTOR | | | |
| J1 | 3 Cond, Single Close Ckt | 2586-0011 | Switchcraft | 113B |
| J2 | Coaxial | 2586-0009 | Trompeter | J3DW |
| J3 | Coaxial | 2586-0009 | Trompeter | J3DW |
| | METER | | | |
| M1 | Meter, Level | 1402-0031 | Cushman | |
| | RESISTORS | | | |
| R1 | Pot, 5K, ±10%, 1/2W Lin Tap | 1203-0069 | Allen-Bradley | WA4G0325502UA |
| R2 | Pot, 10K, ±5%, 2W, 10T, WW | 1203-0067 | Spectrol | 534 |
| R3 | Pot, 10K, ±5%, 2W, 10T, WW | 1203-0067 | Spectrol | 534 |
| R4 | Pot, 5K, ±10%, 1/2W Lin Tap | 1203-0069 | Allen-Bradley | WA4G0325502UA |
| R5 | P/O S5/S6 100K | | | |
| | SWITCHES | | | |
| S1 | Lever, 3 pole, 4 pos | 1851-0082 | Cushman | |
| S2 | Toggle, SPST, flat handle | 1850-0017 | C & K | 7101PYZBE |
| S3 | Toggle SPST, flat handle | 1850-0017 | C & K | 7101PYZBE |
| S4 | Toggle, SPST, flat handle | 1850-0017 | C & K | 7101PYZBE |
| S5 | P/O S6 | | | |
| S6 | Rotary, 3 pole, 3 pos w/pot & switch | 1851-0100 | Cushman | |
| S7 | Toggle, SPST, flat handle | 1850-0017 | C & K | 7101PYZBE |
| | Filter, Red Readout | 4941-0023 | Cushman | |

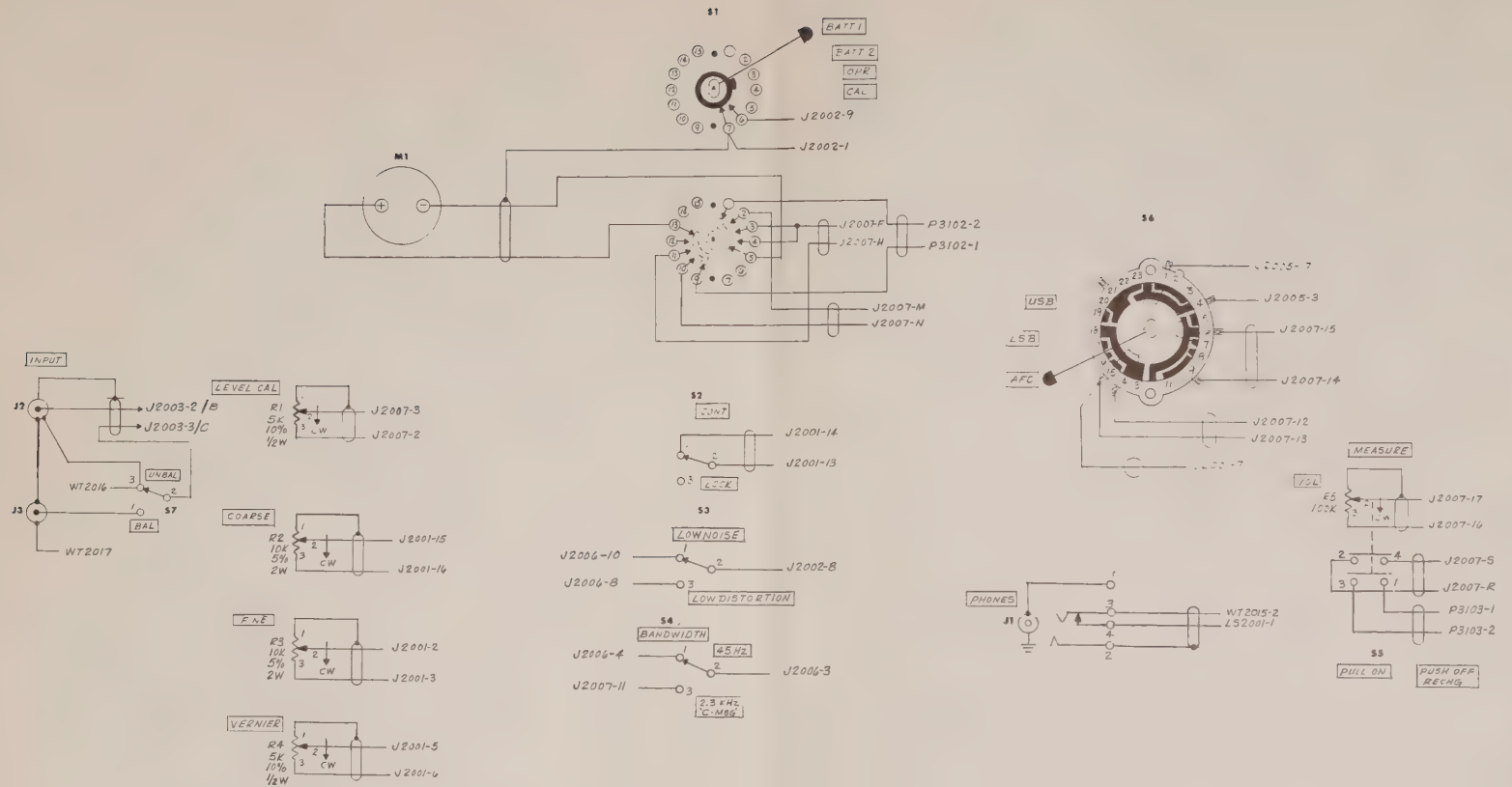
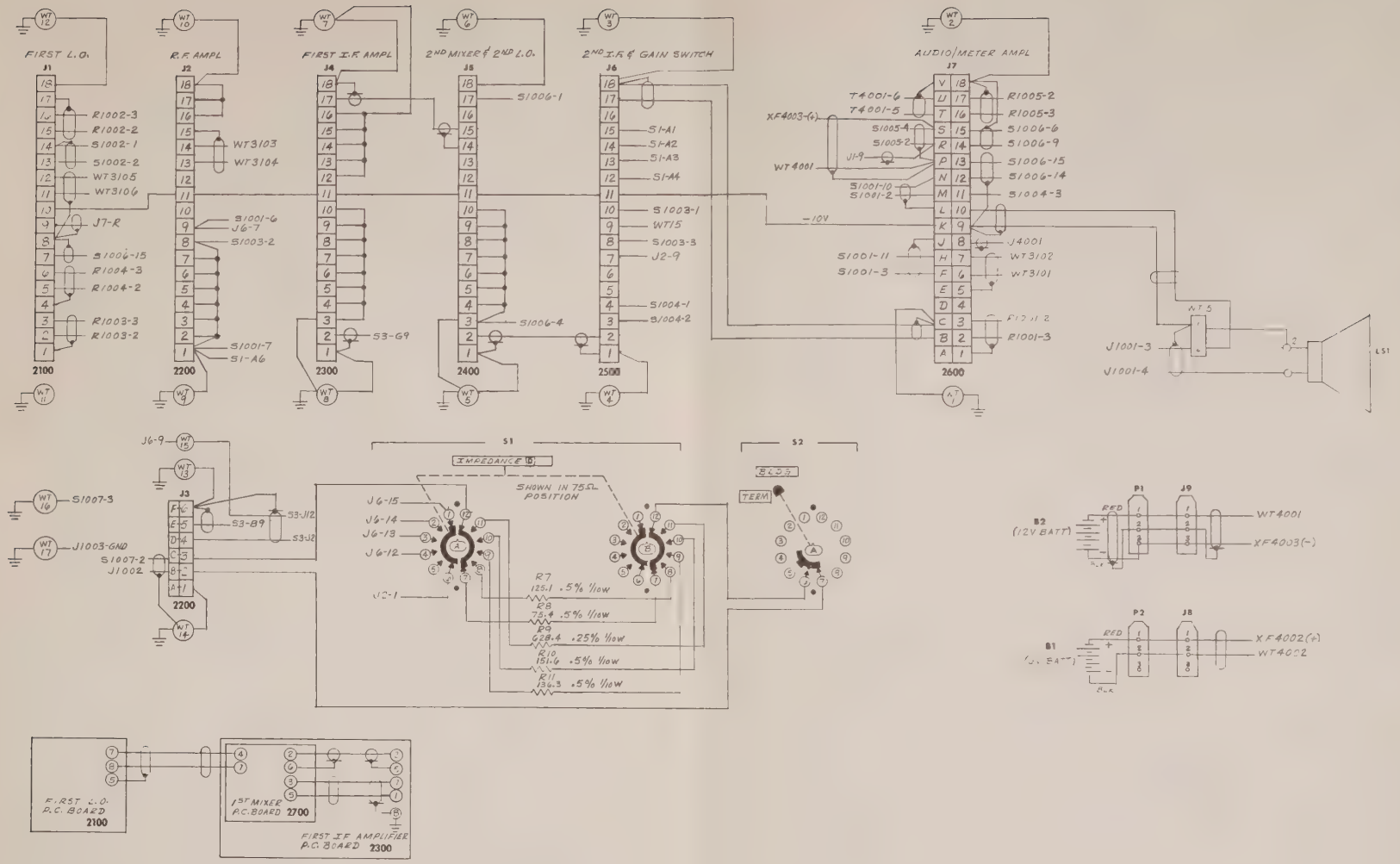



Figure 3-1. Front Panel Interconnection Diagram. 1000

5601**0053**1

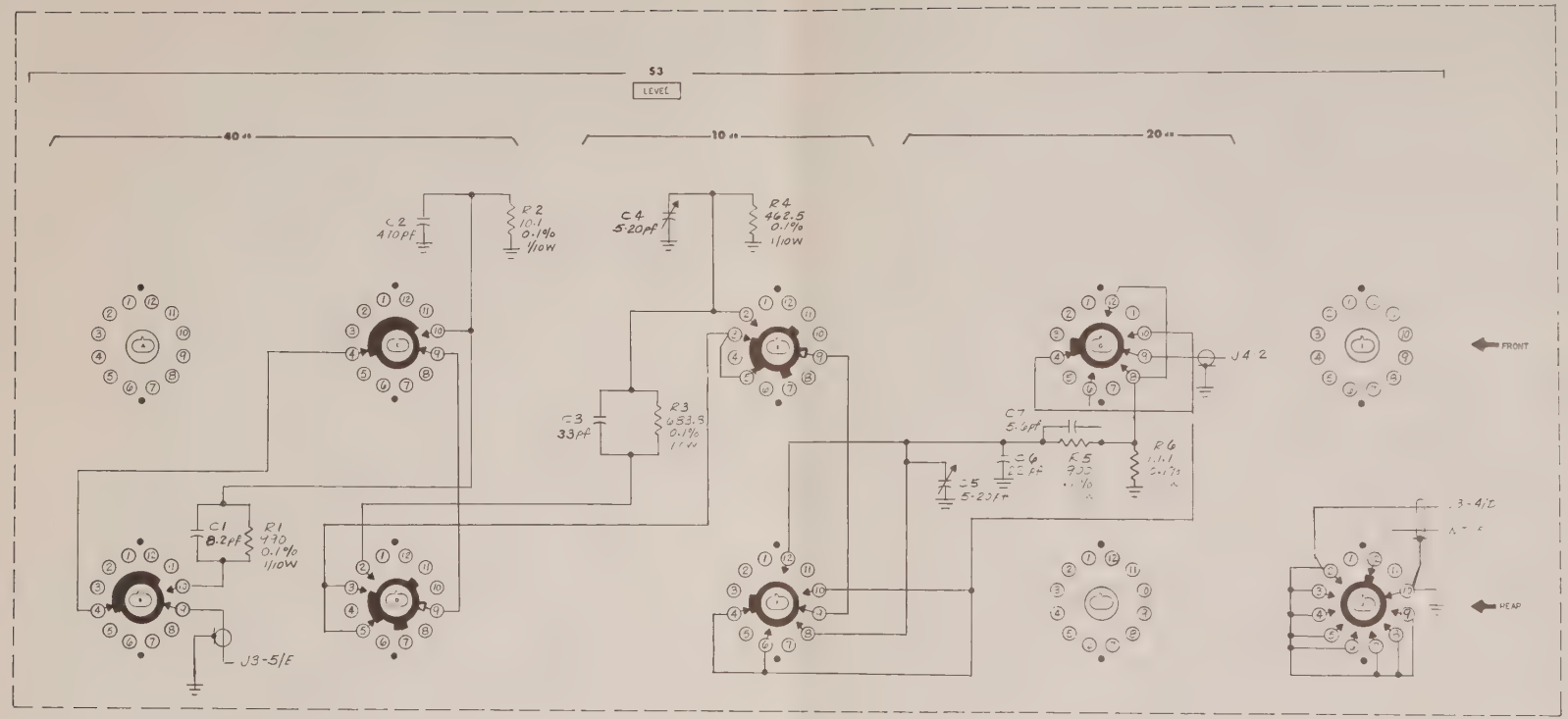
MAIN CHASSIS. 2000

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2000 | Main Chassis | | | |
| | BATTERIES | | | |
| B1 | 6V, Rechargeable | 1046-0008 | Cushman | |
| B2 | 12V, Rechargeable | 1046-0009 | Cushman | |
| | CAPACITORS | | | |
| C1 | Cer, 8.2pF, ±10%, NPO, 100V | 1005-0104 | Erie | 8111-100-C0G0-829K |
| C2 | Cer, 470pF, ±10%, 50V | 1005-0105 | Erie | 8111-050-X7R-471K |
| C3 | Mica, 33 pF, ±5%, 500V | 1004-0006 | Cornell-Dubilier | CD6ED330J |
| C4 | Trim, 5-20pF, +50 -0% N750, 250V | 1001-0014 | R-Triko | 107-02M5-20N750 |
| C5 | Trim, 5-20pF, +50 -0% N750, 250V | 1001-0014 | R-Triko | 107-02M5-20N750 |
| C6 | Mica, 22pF, ±5%, 500V | 1004-0003 | Cornell-Dubilier | CD6ED220J |
| C7 | Cer, 5.6pF, ±10%, NPO, 100V | 1005-0111 | Erie | 8101-100-C0G0-569D |
| | CONNECTORS | | | |
| J1 | 18 contact, single row | 2535-0028 | Masterite | S014GR18SR-BX |
| J2 | 18 contact, single row | 2535-0028 | Masterite | S014GR18SR-BX |
| J3 | 12 contact, double row | 2535-0052 | Masterite | 2MC6D/1-1 |
| J4 | 18 contact, single row | 2535-0028 | Masterite | S014GR18SR-BX |
| J5 | 18 contact, single row | 2535-0028 | Masterite | S014GR18SR-BX |
| J6 | 18 contact, single row | 2535-0028 | Masterite | S014GR18SR-BX |
| J7 | 18 contact, double row | 2535-0067 | Viking | 2VK18D/1-1 |
| J8 | 2 pin plug housing, mini | 2535-0068 | Molex | 03-09-2022 |
| | Pins for J8 | 4153-0012 | Molex | 02-09-2118 |
| J9 | 3 pin plug housing, mini | 2535-0036 | Molex | 1625-3-P-1 |
| | Pins for J9 | 4153-0006 | Molex | 1561TL |
| P1 | 3 pin receptacle housing, mini | 2535-0035 | Molex | 03-06-1032 |
| | pins for P1 | 4153-0007 | Molex | 08-50-0108 |
| P2 | 2 pin receptacle housing, mini | 2535-0069 | Molex | 03-09-1022 |
| | Pins for P2 | 4153-0013 | Molex | 02-09-1118 |
| | RESISTORS | | | |
| R1 | MF, 990Ω, ±.1%, 25PPM, 1/8W | 1074-1048 | Dale | MF 1/8 T9 |
| R2 | MF, 10.1Ω, ±.1%, 25PPM, 1/10W | 1074-1043 | Pyrofilm | PME55 T-9 |
| R3 | MF, 683.8Ω ±.1% 25PPM, 1/10W | 1074-1046 | Dale | MF 1/10 T9 |
| R4 | MF, 462.5Ω, ±.1%, 25PPM, 1/10W | 1074-1045 | Dale | MF 1/10 T9 |
| R5 | MF, 900Ω, ±.1%, 25PPM, 1/10W | 1074-1044 | Dale | MF 1/10 T9 |
| R6 | MF, 111.1Ω, ±.1%, 25PPM, 1/8W | 1074-1047 | Dale | MF 1/10 T9 |
| R7 | MF, 125.1Ω, ±.5%, 25PPM, 1/10W | 1074-0015 | Dale | MF 1/10 T9 |
| R8 | MF, 75.4Ω, ±.5%, 25PPM, 1/10W | 1074-0009 | Dale | MF 1/10 T9 |
| R9 | MF, 628.4Ω, ±.25%, 25PPM, 1/10W | 1074-0045 | Dale | MF 1/10 T9 |
| R10 | MF, 151.6Ω, ±.5% 25PPM, 1/10W | 1074-0017 | Dale | MF 1/10 T9 |
| R11 | MF, 136.3Ω, ±.5%, 25PPM, 1/10W | 1074-0016 | Dale | MF 1/10 T9 |
| R12 | Comp, 51, ±5%, 1/4W | 1066-5105 | Allen-Bradley | CB5105 |
| LS1 | Speaker | 1715-0006 | Quam | 25A07245 |
| | SWITCHES | | | |
| S1 | 5 position rotary, concentric | 1851-0083 | Cushman | |
| S2 | 2 position, P/O S1 | | | |
| S3 | 10 position rotary, 5 section | 1851-0084 | Cushman | |




5601**0053**1

Figure 3-2. Main Chassis Interconnection Diagram, sheet 1. 2000




NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL SWITCHES IN MAX CCW POSITION.

5601**0053**2

Figure 3-3. Main Chassis Interconnection Diagram, sheet 2. 2000

FIRST L. O. 2100

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2100 | 1st L.O. P.C. Board Assembly | 7001-0246 | Cushman | |
| | P.C. Board | 1780-0480 | Cushman | |
| | CAPACITORS | | | |
| C1 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C2 | Mica, 75pF, ±5%, 500V | 1002-0025 | Elmenco | DM15-E-750J |
| C3 | Cer, 2.2pF, ±.25pF, 500V | 1005-0017 | Erie | 301-000-C0J0-229C |
| C4 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C5 | Mica, 150pF, ±5%, 500V | 1002-0021 | Elmenco | DM15-F-151J |
| C6 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C7 | Mica, 27pF, ±5%, 500V | 1002-0008 | Elmenco | DM15-E-270J |
| C8 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C9 | Mica, 47pF, ±5%, 500V | 1002-0012 | Elmenco | DM15-E-470J |
| C10 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C11 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C12 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C13 | Mica, 270pF, ±5%, 500V | 1002-0031 | Elmenco | DM15-F-271J |
| C14 | Mica, 300pF, ±5%, 500V | 1002-0059 | Elmenco | DM15-301J |
| C15 | Tant, 100μF, ±20%, 20V | 1011-0010 | Kemet | T368C106M050AS |
| C16 | Mica, 30pF, ±5%, 500V | 1002-0043 | Elmenco | DM15-E-300J |
| C17 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C18 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C19 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C20 | Mica, 120pF, ±5%, 500V | 1002-0010 | Elmenco | DM15-F-121J |
| C21 | Tant, 100μF, ±20%, 20V | 1011-0010 | Kemet | T368C106M050AS |
| C22 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C23 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C24 | Mica, 30pF, ±5%, 500V | 1002-0043 | Elmenco | DM15-E-300J |
| C25 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C26 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C27 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C28 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C29 | Mica, 150pF, ±5%, 500V | 1002-0021 | Elmenco | DM15-F-151J |
| C30 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C31 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C32 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C33 | Cer, 4.7pF, ±.25pF, 500V | 1005-0015 | Erie | 301-000-C0H0-479C |
| C34 | Tant, 100μF, ±20%, 20V | 1011-0010 | Kemet | T368C106M050AS |
| C35 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C36 | Mica, 1800pF, ±5%, 500V | 1002-0073 | Elmenco | DM19-F-182J |
| C37 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C38 | Cer, 6.8pF, ±.25pF, 500V | 1005-1006 | Erie | 301-000-C0H0-689C |
| C39 | Poly, .0012μF, ±5%, 50V | 1008-0084 | IMB | PA2A122J |
| C40 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C41 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C42 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U-503Z |
| C43 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C44 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C45 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C46 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C47 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C48 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C49 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C50 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |

FIRST L. O. 2100 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| C51 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C52 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C53 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C54 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C55 | Cer, .01μF, ±10%, 100V | 1005-0065 | Aerovox | CK06BX103K |
| C56 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C57 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C58 | Mica, 15pF, ±5%, 500V | 1002-0001 | Elmenco | DM15-C-150J |
| C59 | Mica, 100pF, ±5%, 500V | 1002-0011 | Elmenco | DM15-F-101J |
| C60 | Mica, 510pF, ±5%, 500V | 1002-0036 | Elmenco | DM15-F-511J |
| C61 | Mica, 1000pF, ±5%, 100V | 1002-0015 | Elmenco | DM15-F-102J |
| C62 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C63 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C64 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C65 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| | DIODES | | | |
| CR1 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR2 | Hot Carrier, HPA2800 | 1283-0001 | HPA | HPA2800 |
| CR3 | Hot Carrier, HPA2800 | 1283-0001 | HPA | HPA2800 |
| CR4 | Hot Carrier, HPA2800 | 1283-0001 | HPA | HPA2800 |
| CR5 | Hot Carrier, HPA2800 | 1283-0001 | HPA | HPA2800 |
| CR6 | Si, Varicap, 20MWV, MV1650 | 1281-0037 | Motorola | MV1650 |
| CR7 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR8 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR9 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR10 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR11 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR12 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR13 | Si, Varicap, 12V, 550pF, .4W | 1281-0072 | Motorola | MV1401 |
| CR14 | Si, Dual Varicap, 32V, 40pF | 1281-0058 | Motorola | MV104 |
| | INDUCTORS | | | |
| L1 | RF Choke, .82μH, ±10%, Molded | 1585-0061 | Delevan | 1537-10 |
| L2 | RF Choke, .39μH, ±10%, Molded | 1585-0062 | Delevan | 1537-884 |
| L3 | RF Choke, 15μH, ±10%, Molded | 1585-0034 | Delevan | 1537-40 |
| L4 | RF Choke, .47μH, ±20%, Molded | 1585-0031 | Delevan | 1537-06 |
| L5 | Choke, 2 1/2 T. Wideband | 1586-0001 | Ferroxcube | VK20010/3B |
| L6 | Inductor, Pot Core, 1.8-2.1 μH | 1596-0083 | Cushman | |
| L7 | Choke, 2 1/2T T. Wideband | 1586-0001 | Ferroxcube | VK20010/3B |
| L8 | RF Choke, 3.9μH, ±10%, Molded | 1585-0014 | Delevan | 1537-26 |
| L9 | Choke, 2 1/2 T. Wideband | 1586-0001 | Ferroxcube | VK20010/3B |
| L10 | RF Choke, 1000μH, ±5%, Molded | 1585-0020 | Delevan | 2500-28 |
| L11 | Coil, Variable, 12T | 1596-7902 | Cushman | |
| | INTEGRATED CIRCUITS | | | |
| IC1 | Op. Ampl, LM301A | 2025-0032 | National | LM301A |
| IC2 | Op. Ampl, LM308N | 2025-0070 | National | LM308N |
| | RESISTORS | | | |
| R1 | Comp, 270Ω, ±5%, 1/4W | 1066-2715 | Allen-Bradley | CB2715 |
| R2 | Comp, 270Ω, ±5%, 1/4W | 1066-2715 | Allen-Bradley | CB2715 |
| R3 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| R4 | Comp, 12k, ±5%, 1/4W | 1066-1235 | Allen-Bradley | CB1235 |
| R5 | Comp, 4.7k, ±5%, 1/4W | 1066-4725 | Allen-Bradley | CB4725 |

FIRST L. O. 2100 (cont.)

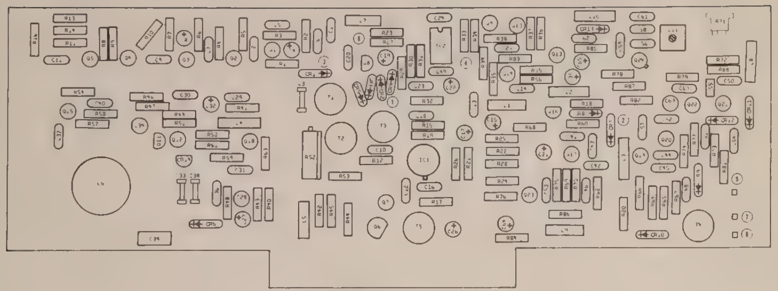
| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R6 | Comp, 47k, ±5%, 1/4W | 1066-4735 | Allen-Bradley | CB4735 |
| R7 | Comp, 10k, ±5%, 1/4W | 1066-1035 | Allen-Bradley | CB1035 |
| R8 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R9 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R10 | MF, 1k, ±1%, 100 PPM, 1/8W | 1075-0037 | Dale | MFF 1/8 T1 |
| R11 | MF, 2k, ±1%, 100 PPM, 1/8W | 1075-0103 | Dale | MFF 1/8 T1 |
| R12 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R13 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R14 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R15 | MF, 61.9k, ±1%, 100 PPM, 1/8W | 1075-0018 | Dale | MFF 1/8 T1 |
| R16 | MF, 4.75k, ±1%, 100 PPM, 1/8W | 1075-0038 | Dale | MFF 1/8 T1 |
| R17 | MF, 10k, ±1%, 100 PPM, 1/8W | 1075-0009 | Dale | MFF 1/8 T1 |
| R18 | Comp, 4.7Ω, ±5%, 1/4W | 1066-0001 | Allen-Bradley | CB0001 |
| R19 | MF, 47.5k, ±1%, 100 PPM, 1/8W | 1075-0076 | Dale | MFF 1/8 T0 |
| R20 | MF, 1 82k, ±1%, 100 PPM, 1/8W | 1075-0065 | Dale | MFF 1/8 T1 |
| R21 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R22 | MF, 4.99k, ±1%, 100 PPM, 1/8W | 1075-0095 | Dale | MFF 1/8 T1 |
| R23 | Comp, 15k, ±5%, 1/4W | 1066-1535 | Allen-Bradley | CB1535 |
| R24 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R25 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R26 | MF, 100Ω, ±1%, 150 PPM, 1/10W | 1074-1033 | Dale | MF 1/10 T9 |
| R27 | Comp, 10k, ±5%, 1/4W | 1066-1035 | Allen-Bradley | CB1035 |
| R28 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R29 | MF, 51.1k, ±1%, 100 PPM, 1/8W | 1075-0099 | Dale | MFF 1/8 T1 |
| R30 | Comp, 620Ω, ±5%, 1/4W | 1066-6215 | Allen-Bradley | CB6215 |
| R31 | Comp, 62k, ±5%, 1/4W | 1066-6235 | Allen-Bradley | CB6235 |
| R32 | MF, 51.1k, ±1%, 100 PPM, 1/8W | 1075-0099 | Dale | MFF 1/8 T1 |
| R33 | Comp, 18k, ±5%, 1/4W | 1066-1835 | Allen-Bradley | CB1835 |
| R34 | Comp, 18k, ±5%, 1/4W | 1066-1835 | Allen-Bradley | CB1835 |
| R35 | Comp, 1.3k, ±5%, 1/4W | 1066-1325 | Allen-Bradley | CB1325 |
| R36 | Comp, 5.1k, ±5%, 1/4W | 1066-5125 | Allen-Bradley | CB5125 |
| R37 | Comp, 200k, ±5%, 1/4W | 1066-2045 | Allen-Bradley | CB2045 |
| R38 | Comp, 130k, ±5%, 1/4W | 1066-1345 | Allen-Bradley | CB1345 |
| R39 | Comp, 62k, ±5%, 1/4W | 1066-6235 | Allen-Bradley | CB6235 |
| R40 | MF, 511Ω, ±1%, 150 PPM, 1/10W | 1074-1008 | Dale | MF 1/10 T9 |
| R41 | MF, 100Ω, ±1%, 150 PPM, 1/10W | 1074-0033 | Dale | MFF 1/10 T9 |
| R42 | MF, 6.19k, ±1%, 100 PPM, 1/8W | 1075-0109 | Dale | MFF 1/8 |
| R43 | MF, 100k, ±1%, 100 PPM, 1/8W | 1075-0105 | Dale | MFF 1/8 T1 |
| R44 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R45 | MF, 18.2k, ±1%, 100 PPM, 1/8W | 1075-0075 | Dale | MFF 1/8 T0 |
| R46 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R47 | MF, 4.75k, ±1%, 100 PPM, 1/8W | 1075-0038 | Dale | MFF 1/8 T1 |
| R48 | MF, 100k, ±1%, 100 PPM, 1/8W | 1075-0105 | Dale | MFF 1/8 T1 |
| R49 | MF, 24.3k, ±1%, 100 PPM, 1/8W | 1075-0097 | Dale | MFF 1/8 T1 |
| R50 | MF, 1/82k, ±1%, 100 PPM, 1/8W | 1075-0065 | Dale | MFF 1/8 T1 |
| R51 | MF, ±1%, 100 PPM, 1/8W | 1075-0037 | Dale | MFF 1/8 T1 |
| R52 | Pot, 10k, ±10%, 3/4W | 1215-0014 | Helitrim | 89WR |
| R53 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R54 | MF, 10k, ±1%, 100 PPM, 1/8W | 1075-0009 | Dale | MFF 1/8 T1 |
| R55 | Comp, 91k, ±5%, 1/4W | 1066-9135 | Allen-Bradley | CB9135 |
| R56 | Comp, FSV, ±5%, 1/4W | 1066-XXXX | Allen-Bradley | CBXXXX |
| R57 | MF, 1MΩ, ±1%, 150 PPM, 1/10W | 1074-1039 | Dale | MF 1/10 T9 |
| R58 | MF, 2k, ±1%, 100 PPM, 1/8W | 1075-0103 | Dale | MFF 1/8 T1 |
| R59 | MF, 100k, ±1%, 100 PPM, 1/8W | 1075-0105 | Dale | MFF 1/8 T1 |
| R60 | MF, 100Ω, ±1%, 150 PPM, 1/10W | 1074-1033 | Dale | MF 1/10 T9 |

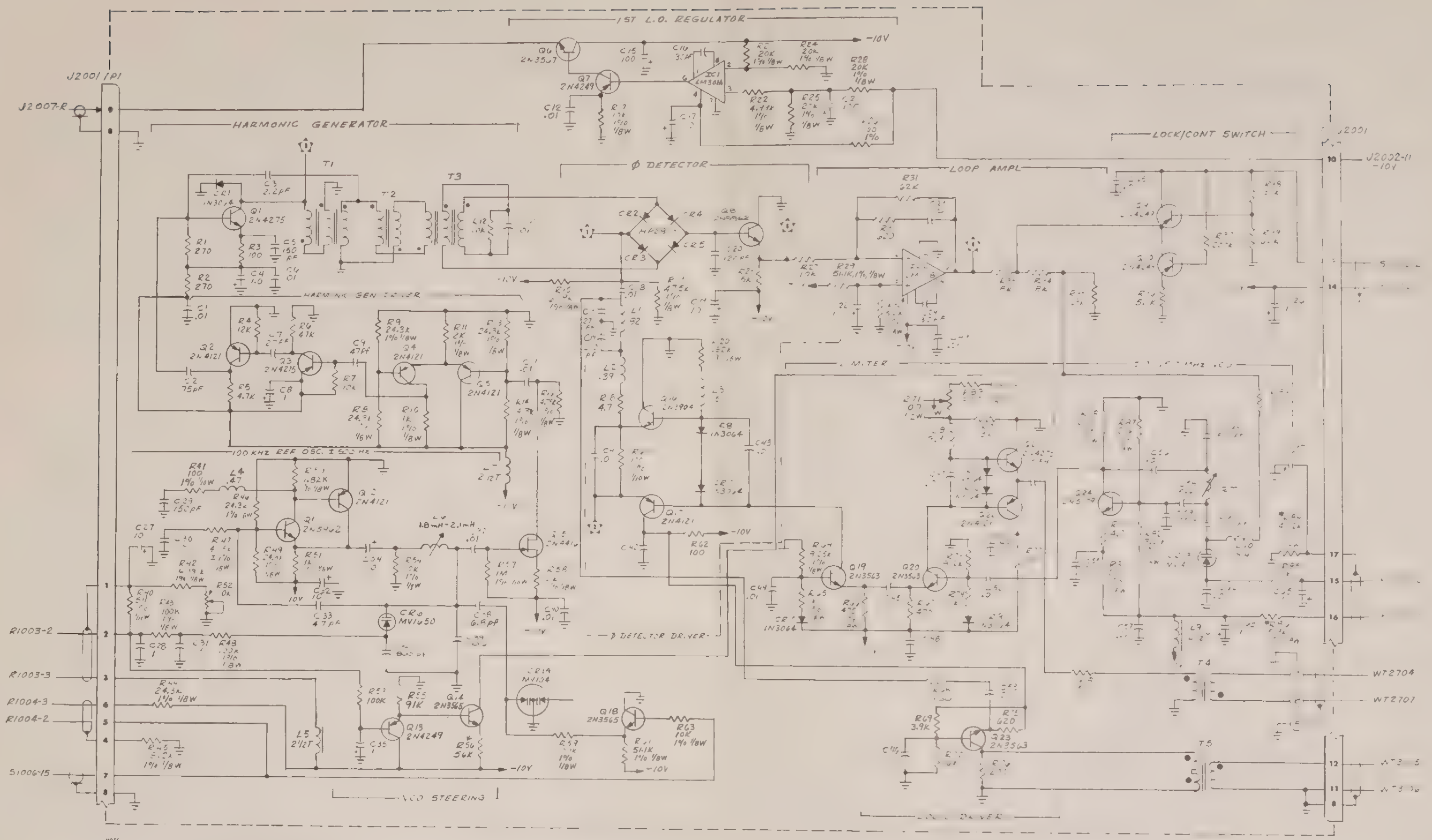
FIRST L. O. 2100 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R61 | MF, 51.1k, ±1%, 100 PPM, 1/8W | 1075-0099 | Dale | MFF 1/8 T1 |
| R62 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1045 |
| R63 | MF, 10k, ±1%, 100 PPM, 1/8W | 1075-0009 | Dale | MFF 1/8 T1 |
| R64 | MF, 8.25k, ±1%, 100 PPM, 1/8W | 1075-0014 | Dale | MFF 1/8 T1 |
| R65 | MF, 1k, ±1%, 100 PPM, 1/8W | 1075-0037 | Dale | MFF 1/8 T1 |
| R66 | MF, 475Ω, ±1%, 100 PPM, 1/8W | 1075-0023 | Dale | MFF 1/8 T1 |
| R67 | Comp, 470Ω, ±5%, 1/4W | 1066-4715 | Allen-Bradley | CB4715 |
| R68 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R69 | Comp, 3.9k, ±5%, 1/4W | 1066-3925 | Allen-Bradley | CB3925 |
| R70 | Comp, 16k, ±5%, 1/4W | 1066-1635 | Allen-Bradley | CB1035 |
| R71 | Pot, 100Ω, ±20%, 1/2W | 1203-0092 | Beckman | 91X-R100 |
| R72 | Comp, 3k, ±5%, 1/4W | 1066-3025 | Allen-Bradley | CB3025 |
| R73 | Comp, 8.2k, ±5%, 1/4W | 1066-8225 | Allen-Bradley | CB8225 |
| R74 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R75 | Comp, 620Ω, ±5%, 1/4W | 1066-6215 | Allen-Bradley | CB6215 |
| R76 | Comp, 200Ω, ±5%, 1/4W | 1066-2015 | Allen-Bradley | CB2015 |
| R77 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| R78 | MF, 237Ω, ±1%, 150 PPM, 1/10W | 1074-1041 | Dale | MF 1/10 T9 |
| R79 | Comp, 4.7Ω, ±5%, 1/4W | 1066-0001 | Allen-Bradley | CB0001 |
| R80 | MF, 200Ω, ±1%, 100 PPM, 1/8W | 1075-0082 | Dale | MFF 1/8 T1 |
| R81 | Comp, 51Ω, ±5%, 1/4W | 1066-5105 | Allen-Bradley | CB5105 |
| R82 | MF, 3.01k, ±1%, 100 PPM, 1/8W | 1075-0127 | Dale | MFF 1/8 T1 |
| R83 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| R84 | MF, FSV, ±1%, 100 PPM, 1/8W | 1075-xxxx | Dale | MFF 1/8 T1 |
| R85 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R86 | MF, FSV, ±1%, 100 PPM, 1/8W | 1075-xxxx | Dale | MFF 1/8 T1 |
| R87 | MF, 12.1k, ±1%, 100 PPM, 1/8W | 1075-0011 | Dale | MFF 1/8 T1 |
| R88 | Comp, 300Ω, ±5%, 1/4W | 1066-3015 | Allen-Bradley | CB3015 |
| | TRANSFORMERS | | | |
| T1 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T2 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T3 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T4 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T5 | Toroid, Trifilar | 1579-0017 | Cushman | |
| | TRANSISTORS | | | |
| Q1 | Si, NPN, 2N4275 | 1272-0016 | Fairchild | 2N4275 |
| Q2 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q3 | Si, NPN, 2N4275 | 1272-0016 | Fairchild | 2N4275 |
| Q4 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q5 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q6 | Si, NPN, 2N3567 | 1272-0014 | Fairchild | 2N3567 |
| Q7 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q8 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q9 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q10 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q11 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q12 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q13 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q14 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q15 | J-FET, N-Channel, 2N4416 | 1272-0048 | Teledyne | 2N4416 |
| Q16 | Si, NPN, 2N3904 | 1272-0032 | Motorola | 2N3904 |
| Q17 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q18 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q19 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |
| Q20 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |

FIRST L. O. 2100 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| Q21 | Si, NPN, 2N4275 | 1272-0016 | Fairchild | 2N4275 |
| Q22 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q23 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |
| Q24 | Si, NPN, 2N5179 | 1272-0060 | Motorola | 2N5179 |






NOTE

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 3-4. First L.O. 2100

5601-0053-2

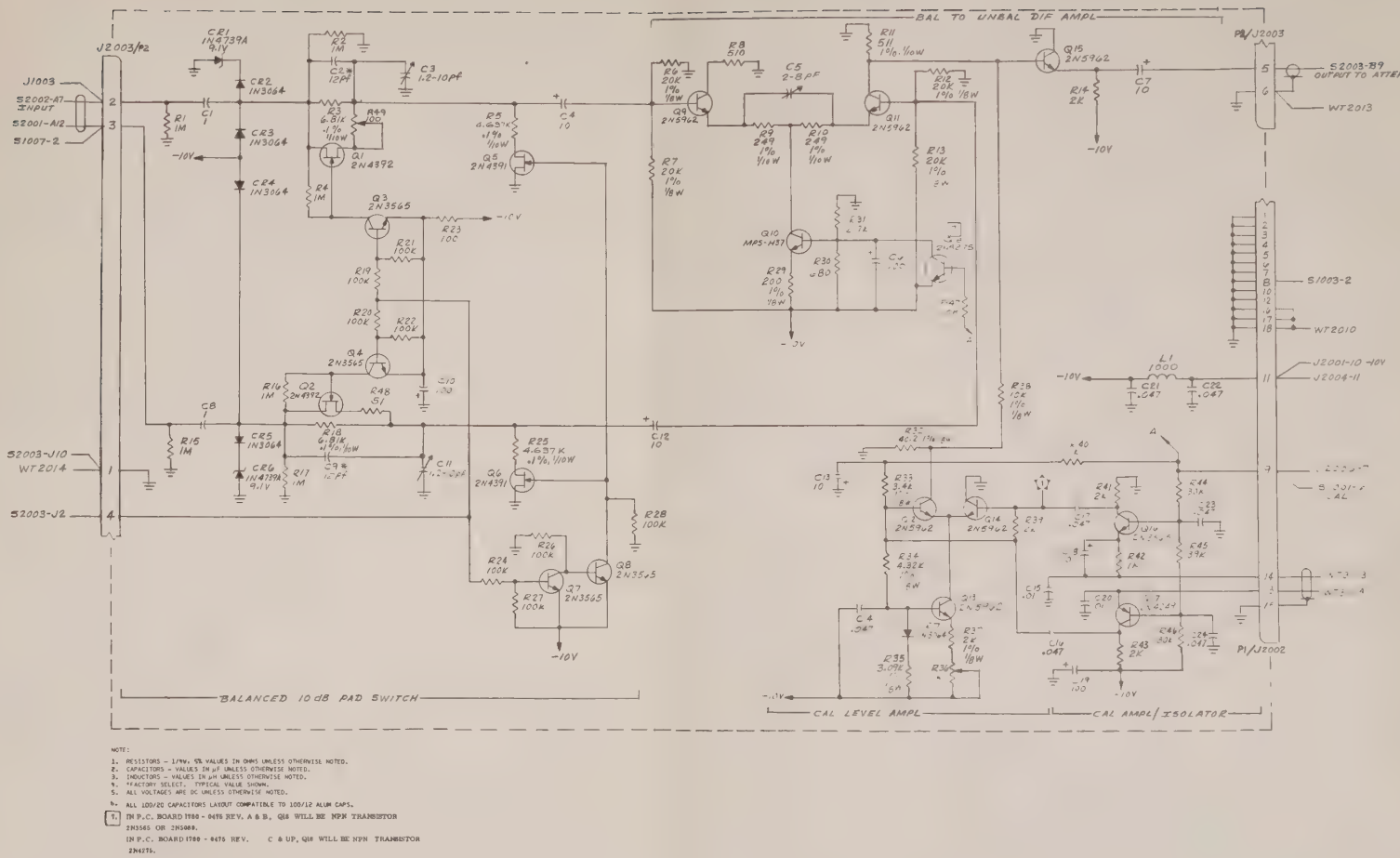
R. F. AMPLIFIER. 2200

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2200 | RF Amplifier Assembly | 7001-0247 | Cushman | |
| | P. C. Board | 1780-0475 | Cushman | |
| | CAPACITORS | | | |
| C1 | Met. Mylar, 1μF, ±20%, 400V | 1008-0072 | Electrocube | 230B1E105M |
| C2 | Mica, FSV, ±5%, 500V | 1002-XXXX | Elmenco | |
| C3 | Trim, 1.2-10pF, -0, +50%, 250V | 1001-0013 | R-Triko | 122095 |
| C4 | Elect, 10μF, ±20%, 35V | 1013-0044 | Nichicon | 35UKB10M |
| C5 | Trim, 2-8pF, 350V | 1001-0010 | Erie | 538-006A |
| C6 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C7 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C8 | Met. Mylar, 1μF, ±20%, 400V | 1008-0072 | Electrocube | 230B1E105M |
| C9 | Mica, FSV, ±5%, 500V | 1002-XXXX | Elmenco | |
| C10 | Tant, 100μF, ±20%, 20V | 1011-0011 | Kemet | T368C106M050AS |
| C11 | Trim, 1.2-10pF, -0, +50%, 250V | 1001-0013 | R-Triko | 122095 |
| C12 | Elect, 10μF, ±20%, 35V | 1013-0044 | Nichicon | 35UKB10M |
| C13 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C14 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C15 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C16 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C17 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C18 | Tant, 10μF, 50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C19 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C20 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C21 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C22 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C23 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C24 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| | DIODES | | | |
| CR1 | Si, Zener, 9.1V, ±5%, 1W, 1N4739A | 1281-0027 | IRC | 1N4739A |
| CR2 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR3 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR4 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR5 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR6 | Si, Zener, 9.1V, ±5%, 1N4739A | 1281-0027 | IRC | 1N4739A |
| CR7 | Si, Signal, 75 PIV, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| | INDUCTOR | | | |
| L1 | RF Choke, 1000μH, ±5% | 1585-0020 | Delevan | 2500-28 |
| | RESISTORS | | | |
| R1 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R2 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R3 | MF, 6.81k, ±.1%, 25 PPM, 1/10W | 1074-0057 | Dale | MF 1/10 T9 |
| R4 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R5 | MF, 4.637k, ±.1%, 25 PPM, 1/10W | 1074-1053 | Dale | MF 1/10 T9 |
| R6 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R7 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R8 | Comp, 510Ω, ±5%, 1/4W | 1066-5115 | Allen-Bradley | CB5115 |
| R9 | MF, 249Ω, ±1%, 100 PPM, 1/10W | 1074-0098 | Dale | MF 1/10 T1 |
| R10 | MF, 249Ω, ±1%, 100 PPM, 1/10W | 1074-0098 | Dale | MF 1/10 T1 |

R. F. AMPLIFIER. 2200

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R11 | MF, 511Ω, ±1%, 150 PPM, 1/10W | 1074-1008 | Dale | RN55D5110-F |
| R12 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R13 | MF, 20k, ±1%, 100 PPM, 1/8W | 1075-0096 | Dale | MFF 1/8 T1 |
| R14 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R15 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R16 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R17 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R18 | MF, 6.8k, ±.1%, 25 PPM, 1/10W | 1074-0057 | Dale | MF 1/10 T9 |
| R19 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R20 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R21 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R22 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R23 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| R24 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R25 | MF, 4.637k, ±.1%, 25 PPM, 1/10W | 1074-1053 | Dale | MF 1/10 T9 |
| R26 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R27 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R28 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R29 | MF, 200Ω, ±1%, 100 PPM, 1/8W | 1075-0082 | Dale | MFF 1/8 T1 |
| R30 | Comp, 680Ω, ±5%, 1/4W | 1066-6815 | Allen-Bradley | CB6815 |
| R31 | Comp, 2.7k, ±5%, 1/4W | 1066-2725 | Allen-Bradley | CB2725 |
| R32 | MF, 40.2Ω, ±1%, 100 PPM, 1/8W | 1075-0124 | Dale | MFF 1/8 T1 |
| R33 | MF, 3.4k, ±1%, 100 PPM, 1/8W | 1075-0020 | Dale | MFF 1/8 T1 |
| R34 | MF, 4.32k, ±1%, 100 PPM, 1/8W | 1075-0111 | Dale | MFF 1/8 RN55D432TF |
| R35 | MF, 3.09k, ±1%, 100 PPM, 1/8W | 1075-0091 | Dale | MFF 1/8 T1 |
| R36 | Pot, 1k, ±10%, 3/4W | 1215-0013 | Helitrim | 89WR |
| R37 | MF, 2k, ±1%, 100 PPM, 1/8W | 1075-0103 | Dale | MFF 1/8 T1 |
| R38 | MF, 10k, ±1%, 100 PPM, 1/8W | 1075-0009 | Dale | MFF 1/8 T1 |
| R39 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R40 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R41 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R42 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R43 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R44 | Comp, 30k, ±5%, 1/4W | 1066-3035 | Allen-Bradley | CB3035 |
| R45 | Comp, 39k, ±5%, 1/4W | 1066-3935 | Allen-Bradley | CB3935 |
| R46 | Comp, 30k, ±5%, 1/4W | 1066-3035 | Allen-Bradley | CB3035 |
| R47 | Comp, 10k, ±5%, 1/4W | 1066-1035 | Allen-Bradley | CB1035 |
| R48 | Comp, 51Ω, ±5%, 1/4W | 1066-5105 | Allen-Bradley | CB5105 |
| R49 | Pot, 100Ω, ±20%, 1/2W | 1203-0092 | Beckman | 91X-R100 |
| | TRANSISTORS | | | |
| Q1 | Xstr, J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q2 | Xstr, J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q3 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q4 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q5 | J-FET, N-Chan, 2N4391 | 1272-0042 | Teledyne | 2N4391 |
| Q6 | J-FET, N-Chan, 2N4391 | 1272-0042 | Teledyne | 2N4391 |
| Q7 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q8 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q9 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q10 | Si, NPN, MPS-H37 | 1272-0073 | Motorola | MPS-H37 |
| Q11 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q12 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q13 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q14 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q15 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q16 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q17 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q18 | Si, NPN, 2N4275 | 1272-0016 | Fairchild | 2N4275 |

[1] FACTORY SELECT VALUE




NOTE:

1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL 100/20 CAPACITORS LAYOUT COMPATIBLE TO 100/12 ALUM CAPS.
7. IN P.C. BOARD 1780 - 0476 REV. A & B, Q8 WILL BE NPN TRANSISTOR 2N3565 OR 2N5089.
   IN P.C. BOARD 1780 - 0476 REV. C & UP, Q8 WILL BE NPN TRANSISTOR 2N4275.

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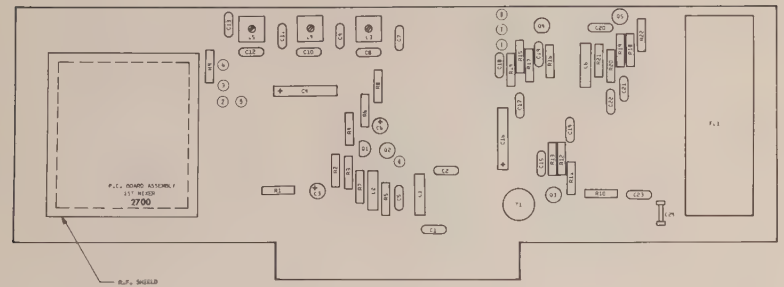
Figure 3-5. R.F. Amplifier. 2200

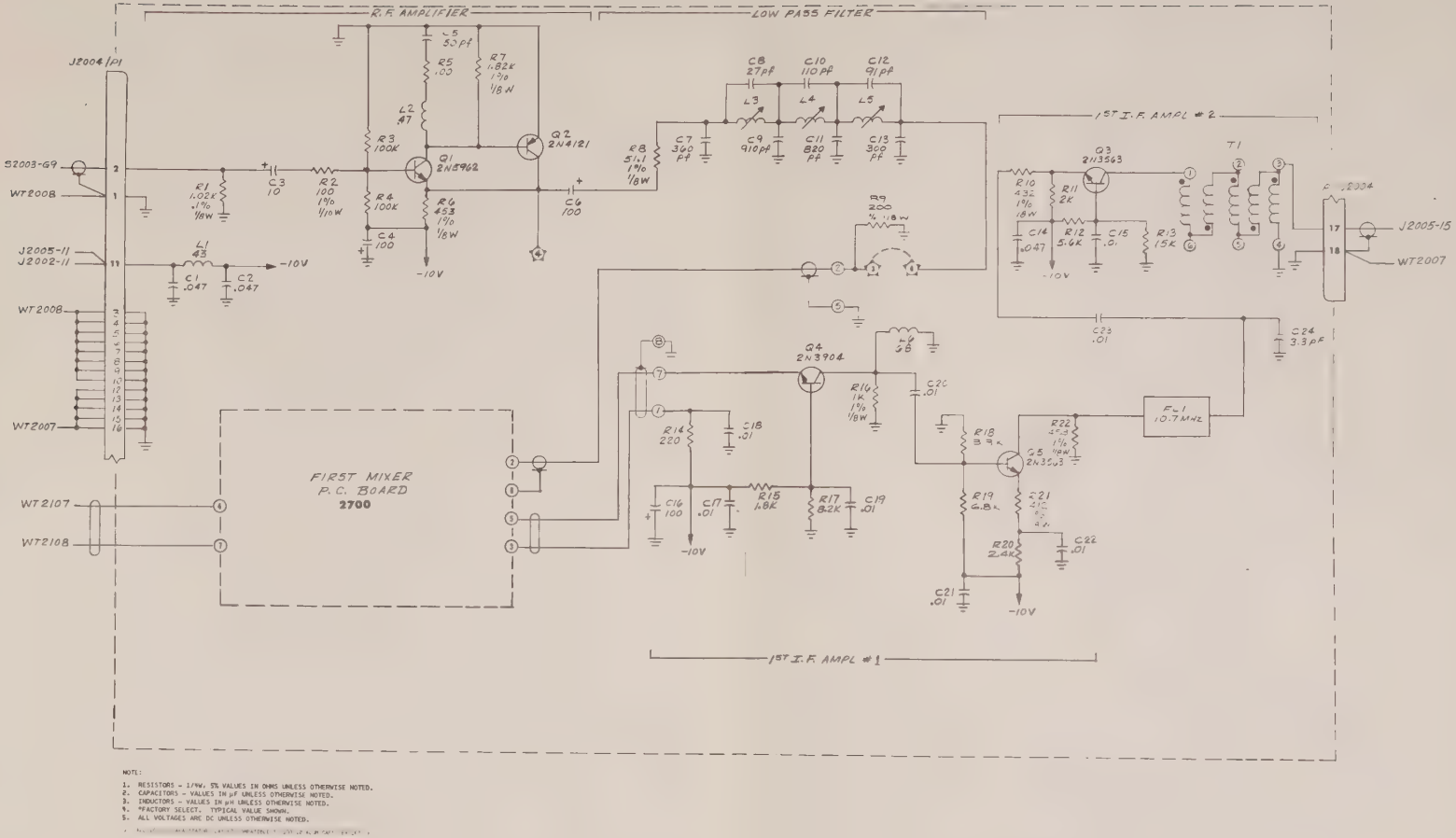
FIRST I. F. AMPLIFIER. 2300

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2300 | 1st I.F. Amplifier Assembly | 7001-0248 | Cushman | |
| | P.C. Board | 1780-0476 | Cushman | |
| | CAPACITORS | | | |
| C1 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C2 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C3 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C4 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C5 | Mica, 150pF, ±5%, 500V | 1002-0021 | Elmenco | DM15-F-151J |
| C6 | Tant, 100μF, ±20%, 20V | 1011-0010 | Kemet | T362D107M020AS |
| C7 | Mica, 360pF, ±5%, 500V | 1002-0040 | Elmenco | DM15-F-361J |
| C8 | Mica, 27pF, ±5%, 500V | 1002-0008 | Elmenco | DM15-E-270J |
| C9 | Mica, 910pF, ±5%, 500V | 1002-0062 | Elmenco | DM-5-F-911J |
| C10 | Mica, 110pF, ±5%, 500V | 1002-0026 | Elmenco | DM-5-F-111J |
| C11 | Mica, 820pF, ±5%, 300V | 1002-0039 | Elmenco | DM15-F-821J |
| C12 | Mica, 91pF, ±5%, 500V | 1002-0027 | Elmenco | DM15-F-910J |
| C13 | Mica, 300pF, ±5%, 500V | 1002-0059 | Elmenco | DM15-F-301J |
| C14 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C15 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C16 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C17 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C18 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C19 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5935-512-Y5U-103Z |
| C20 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C21 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C22 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C23 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C24 | Cer, 3.3pF, ±.25pF, 500V | 1005-0011 | Erie | 301-000-C0J0-339C |
| | FILTER | | | |
| FL1 | Crystal, 10.7 MHz (3 dB BW=2.3 kHz) | 1040-0031 | Cushman | |
| | INDUCTORS | | | |
| L1 | RF Choke, 43μH, ±5% | 1585-0060 | Delevan | 1537-58 |
| L2 | RF Choke, .47μH, ±20% | 1585-0031 | Delevan | 1537-06 |
| L3 | Coil, Variable | 1596-0078 | Cushman | |
| L4 | Coil, Variable | 1596-0078 | Cushman | |
| L5 | Coil, Variable | 1596-0078 | Cushman | |
| L6 | RF Choke, 68μH, ±5% | 1585-0059 | Delevan | 1537-68 |
| | RESISTORS | | | |
| R1 | MF, 1.02k, .1%, 25 PPM, 1/8W | 1075-0126 | Dale | MFF T8 T9 |
| R2 | MF, 100Ω, ±1%, 150 PPM, 1/10W | 1074-1033 | Dale | RN55D1000F |
| R3 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R4 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R5 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| R6 | MF, 453Ω, ±1%, 100 PPM, 1/8W | 1075-0107 | Dale | MFF 1/8 T1 |
| R7 | MF, 1.82k, ±1%, 100 PPM 1/8W | 1075-0065 | Dale | MFF 1/8 T1 |
| R8 | MF, 51.1Ω, ±1%, 150 PPM, 1/8W | 1075-0077 | Dale | MFF 1/8 T0 |
| R9 | MF, 200Ω, ±1%, 100 PPM, 1/8W | 1075-0082 | Dale | MFF 1/8 T1 |
| R10 | MF, 432Ω, ±1%, 100 PPM, 1/8W | 1075-0142 | Dale | RN55D |

FIRST I. F. AMPLIFIER. 2300 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R11 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R12 | Comp, 5.6k, ±5%, 1/4W | 1066-5625 | Allen-Bradley | CB5625 |
| R13 | Comp, 15k, ±5%, 1/4W | 1066-1535 | Allen-Bradley | CB1535 |
| R14 | Comp, 220Ω, ±5%, 1/4W | 1066-2215 | Allen-Bradley | CB2215 |
| R15 | Comp, 1.8k, ±5%, 1/4W | 1066-1825 | Allen-Bradley | CB1825 |
| R16 | MF, 1.00k, ±1%, 100 PPM, 1/8W | 1075-0037 | Dale | MFF 1/8 T1 |
| R17 | Comp, 8.2k, ±5%, 1/4W | 1066-8225 | Allen-Bradley | CB8225 |
| R18 | Comp, 3.3k, ±5%, 1/4W | 1066-3325 | Allen-Bradley | CB3325 |
| R19 | Comp, 6.8k, ±5%, 1/4W | 1066-6825 | Allen-Bradley | CB6825 |
| R20 | Comp, 2.4k, ±5%, 1/4W | 1066-2425 | Allen-Bradley | CB2425 |
| R21 | MF, 412Ω, ±1%, 100 PPM, 1/8 | 1075-0084 | Dale | MFF 1/8 T1 |
| R22 | MF, 453Ω, ±1%, 100 PPM, 1/10W | 1075-0107 | Dale | MFF 1/8 T1 |
| | TRANSFORMER | | | |
| T1 | Toroid | 1579-0036 | Cushman | |
| | TRANSISTORS | | | |
| Q1 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q2 | Si, PNP, 2N4121 | 1272-0023 | Fairchild | 2N4121 |
| Q3 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |
| Q4 | Si, NPN, 2N3904 | 1272-0032 | Motorola | 2N3904 |
| Q5 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |




NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

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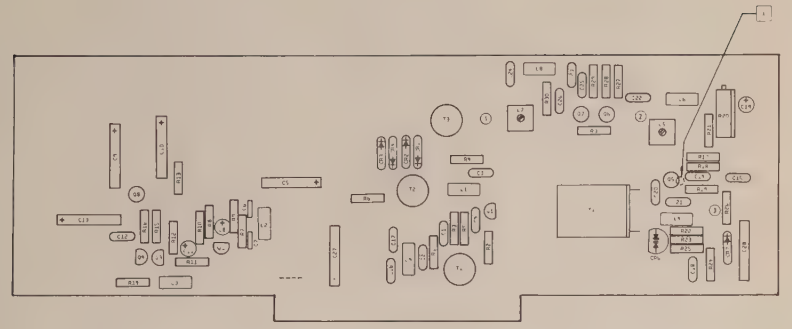
Figure 3-6. First I. F. Amplifier. 2300

SECOND MIXER AND SECOND L. O. 2400

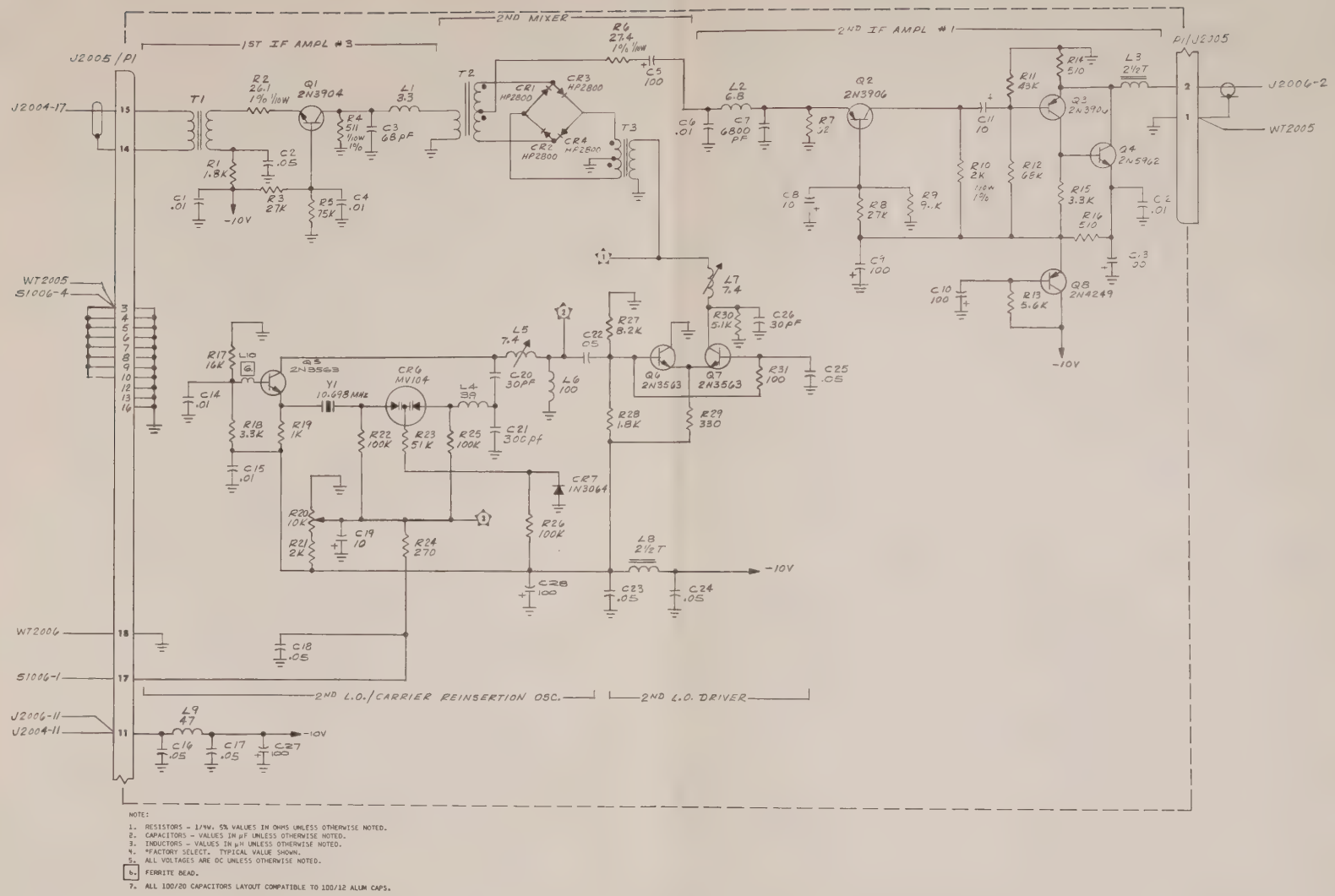
| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2400 | 2nd Mixr & 2nd L.O. Assembly | 7001-0249 | Cushman | |
| | P. C. Board | 1780-0477 | Cushman | |
| | CAPACITORS | | | |
| C1 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C2 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C3 | Mica, 68pF, ±5%, 500V | 1002-0013 | Elmenco | DM15-E-680J |
| C4 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C5 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C6 | Cer, .01μF, ±10%, 100V | 1005-0065 | Aerovox | CK06BX103K |
| C7 | Cer, 6800pF, ±10%, 200V | 1005-0099 | Aerovox | CK06BX682K |
| C8 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C9 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C10 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C11 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C12 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C13 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C14 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C15 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C16 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C17 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C18 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C19 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C20 | Mica, 30pF, ±5%, 500V | 1002-0043 | Elmenco | DM15-E-300J |
| C21 | Mica, 300pF, ±5%, 500V | 1002-0059 | Elmenco | DM15-E-301J |
| C22 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C23 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C24 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C25 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C26 | Mica, 30pF, ±5%, 500V | 1002-0043 | Elmenco | DM15-E-300J |
| C27 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C28 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| | CRYSTAL | | | |
| Y1 | Crystal, 10.698 MHz | 2035-0020 | Cushman | |
| | DIODES | | | |
| CR1 | Hot-Carrier, HPA 2800 | 1283-0001 | HPA | 5082-2800 |
| CR2 | Hot-Carrier, HPA 2800 | 1283-0001 | HPA | 5082-2800 |
| CR3 | Hot-Carrier, HPA 2800 | 1283-0001 | HPA | 5082-2800 |
| CR4 | Hot-Carrier, HPA 2800 | 1283-0001 | HPA | 5082-2800 |
| CR5 | Not Used | | | |
| CR6 | Si, Varicap, Dual, MV104 | 1281-0058 | Motorola | MV104 |
| CR7 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| | INDUCTORS | | | |
| L1 | RF Choke, 3.3μH, ±10% | 1585-0037 | Delevan | 1537-24 |
| L2 | RF Choke, 6.8μH, ±10% | 1585-0015 | Delevan | 1537-32 |
| L3 | Choke, Wide Band 2 1/2 T | 1586-0001 | Ferroxcube | VK200 10/3B |
| L4 | RF Choke, 3.9μH, ±10% | 1585-0014 | Delevan | 1537-26 |
| L5 | Coil, Var. | 1596-7901 | Cushman | |

SECOND MIXER AND SECOND L. O. 2400 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| L6 | RF Choke, 100μH, ±5% | 1585-0017 | Delevan | 1537-76 |
| L7 | Coil, Var. | 1596-7901 | Cushman | |
| L8 | Choke, Wide Band 2 1/2 T | 1586-0001 | Ferroxcube | VK200 10/3B |
| L9 | RF Choke, 47μH, ±5% | 1585-0010 | Delevan | 1537-60 |
| L10 | Choke, Ferrite Bead U-250 | 1586-0004 | Ferroxcube | 56-590-65/4B |
| | RESISTORS | | | |
| R1 | Comp, 1.8k, ±5%, 1/4W | 1066-1825 | Allen-Bradley | CB1825 |
| R2 | MF, 26.1Ω, ±1%, 150 PPM, 1/10W | 1074-1011 | Dale | RN55D26R1-F |
| R3 | Comp, 27k, ±5%, 1/4W | 1066-2735 | Allen-Bradley | CB2735 |
| R4 | MF, 511Ω, ±1%, 150 PPM, 1/10W | 1074-1008 | Dale | RN55D5110-F |
| R5 | Comp, 75k, ±5%, 1/4W | 1066-7535 | Allen-Bradley | CB7535 |
| R6 | MF, 27.4Ω, ±1%, 150PPM, 1/10W | 1074-1012 | Dale | RN55D27R4-F |
| R7 | Comp, 620Ω, ±5%, 1/4W | 1066-6215 | Allen-Bradley | CB6215 |
| R8 | Comp, 27k, ±5%, 1/4W | 1066-2735 | Allen-Bradley | CB2735 |
| R9 | Comp, 9.1k, ±5%, 1/4W | 1066-9125 | Allen-Bradley | CB9125 |
| R10 | MF, 2k, ±1%, 100 PPM, 1/10W | 1075-0079 | Dale | MFF 1/10 |
| R11 | Comp, 43k, ±5%, 1/4W | 1066-4335 | Allen-Bradley | CB4335 |
| R12 | Comp, 68k, ±5%, 1/4W | 1066-6835 | Allen-Bradley | CB6835 |
| R13 | Comp, 5.6k, ±5%, 1/4W | 1066-5625 | Allen-Bradley | CB5625 |
| R14 | Comp, 510Ω, ±5%, 1/4W | 1066-5115 | Allen-Bradley | CB5115 |
| R15 | Comp, 3.3k, ±5%, 1/4W | 1066-3325 | Allen-Bradley | CB3325 |
| R16 | Comp, 510Ω, ±5%, 1/4W | 1066-5115 | Allen-Bradley | CB5115 |
| R17 | Comp, 16k, ±5%, 1/4W | 1066-1635 | Allen-Bradley | CB1635 |
| R18 | Comp, 3.3k, ±5%, 1/4W | 1066-3325 | Allen-Bradley | CB3325 |
| R19 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R20 | Pot, 10k, ±10%, 3/4W | 1215-0014 | Helitrim | 89WR |
| R21 | Comp, 2k, ±5%, 1/4W | 1066-2025 | Allen-Bradley | CB2025 |
| R22 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R23 | Comp, 51k, ±5%, 1/4W | 1066-5135 | Allen-Bradley | CB5135 |
| R24 | Comp, 270Ω, ±5%, 1/4W | 1066-2715 | Allen-Bradley | CB2715 |
| R25 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R26 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R27 | Comp, 8.2k, ±5%, 1/4W | 1066-8225 | Allen-Bradley | CB8225 |
| R28 | Comp, 1.8k, ±5%, 1/4W | 1066-1825 | Allen-Bradley | CB1825 |
| R29 | Comp, 330Ω, ±5%, 1/4W | 1066-3315 | Allen-Bradley | CB3315 |
| R30 | Comp, 5.1k, ±5%, 1/4W | 1066-5125 | Allen-Bradley | CB5125 |
| R31 | Comp, 100Ω, ±5%, 1/4W | 1066-1015 | Allen-Bradley | CB1015 |
| | TRANSFORMERS | | | |
| T1 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T2 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T3 | Toroid, Trifilar | 1579-0017 | Cushman | |
| | TRANSISTORS | | | |
| Q1 | Si, NPN, 2N3904 | 1272-0032 | Motorola | 2N3904 |
| Q2 | Si, PNP, 2N3906 | 1272-0037 | Motorola | 2N3907 |
| Q3 | Si, PNP, 2N3906 | 1272-0037 | Motorola | 2N3907 |
| Q4 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |
| Q5 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |
| Q6 | Si, NPN, 2N3563 | 1272-0022 | Fairchild | 2N3563 |
| Q7 | Si, NPN, 2N2563 | 1272-0022 | Fairchild | 2N3563 |
| Q8 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |



1. L10 ON BASE OF QS TRANSISTOR.




NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. FERRITE BEAD.
7. ALL 100/20 CAPACITORS LAYOUT COMPATIBLE TO 100/12 ALUM CAPS.

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Figure 3-7. Second Mixer and Second L. O. 2400

SECOND I. F. AND GAIN SWITCH. 2500

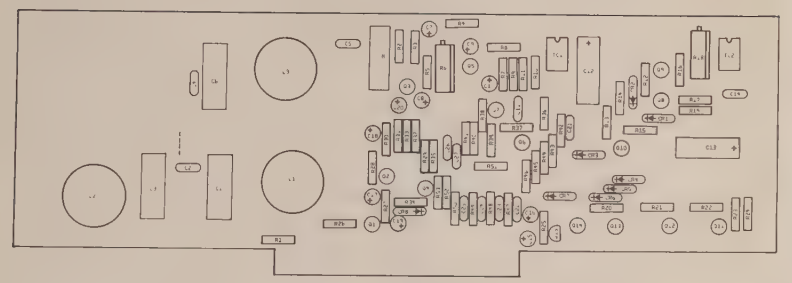
| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2500 | 2nd I. F. & Gain Switch | 7001-0250 | Cushman | |
| | P. C. Board | 1780-0478 | Cushman | |
| | CAPACITORS | | | |
| C1 | Poly, .027μF, ±1%, 50V | 1008-0064 | TRW | 863UW |
| C2 | Mica, 270pF, ±5%, 500V | 1002-0031 | Elmenco | DM15-F-271J |
| C3 | Poly, .027μF, ±1%, 50V | 1008-0064 | TRW | 863UW |
| C4 | Mica, 470pF, ±5%, 500V | 1002-0035 | Elmenco | DM15-F-471J |
| C5 | Cer, .05μF, +80-20%, 25V | 1005-0014 | Erie | 5855-505-Y5U0-503Z |
| C6 | Poly, .027μF, ±1%, 50V | 1008-0064 | TRW | 863UW |
| C7 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C8 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C9 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C10 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C11 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C12 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C13 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| C14 | Cer, .01μF, +80-20%, 25V | 1005-0013 | Erie | 5835-512-Y5U-103Z |
| C15 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C16 | Tant, 100μF, ±20%, 20V | 1011-0010 | Kemet | T362D107M020AS |
| C17 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C18 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C19 | Tant, 1μF, ±20%, 50V | 1011-0013 | Kemet | T368A105M050AS |
| C20 | Tant, 10μF, +50-20%, 35V | 1011-0006 | ITT | TAG-10/35-20 |
| C21 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C22 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C23 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C24 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C25 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C26 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C27 | Cer, .1μF, ±20%, 25V | 1005-0044 | Sprague | 50023104X0250B3 |
| C28 | Elec, 100μF, +75-10%, 12V | 1013-0011 | Sprague | 30D107G012CC5 |
| | DIODES | | | |
| CR1 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR2 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR3 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR4 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR5 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR6 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR7 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| CR8 | Si, Signal, 75V, 1N3064 | 1281-0013 | Teledyne | 1N3064 |
| | INDUCTOR | | | |
| L1 | Pot Core | 1596-0084 | Cushman | |
| L2 | Pot Core | 1596-0084 | Cushman | |
| L3 | Pot Core | 1596-0084 | Cushman | |
| | INTEGRATED CIRCUITS | | | |
| IC1 | Op Amp SN72741P | 2025-0067 | T. I. | SN72741P |
| IC2 | Op Amp SN72741P | 2025-0067 | T. I. | SN72741P |

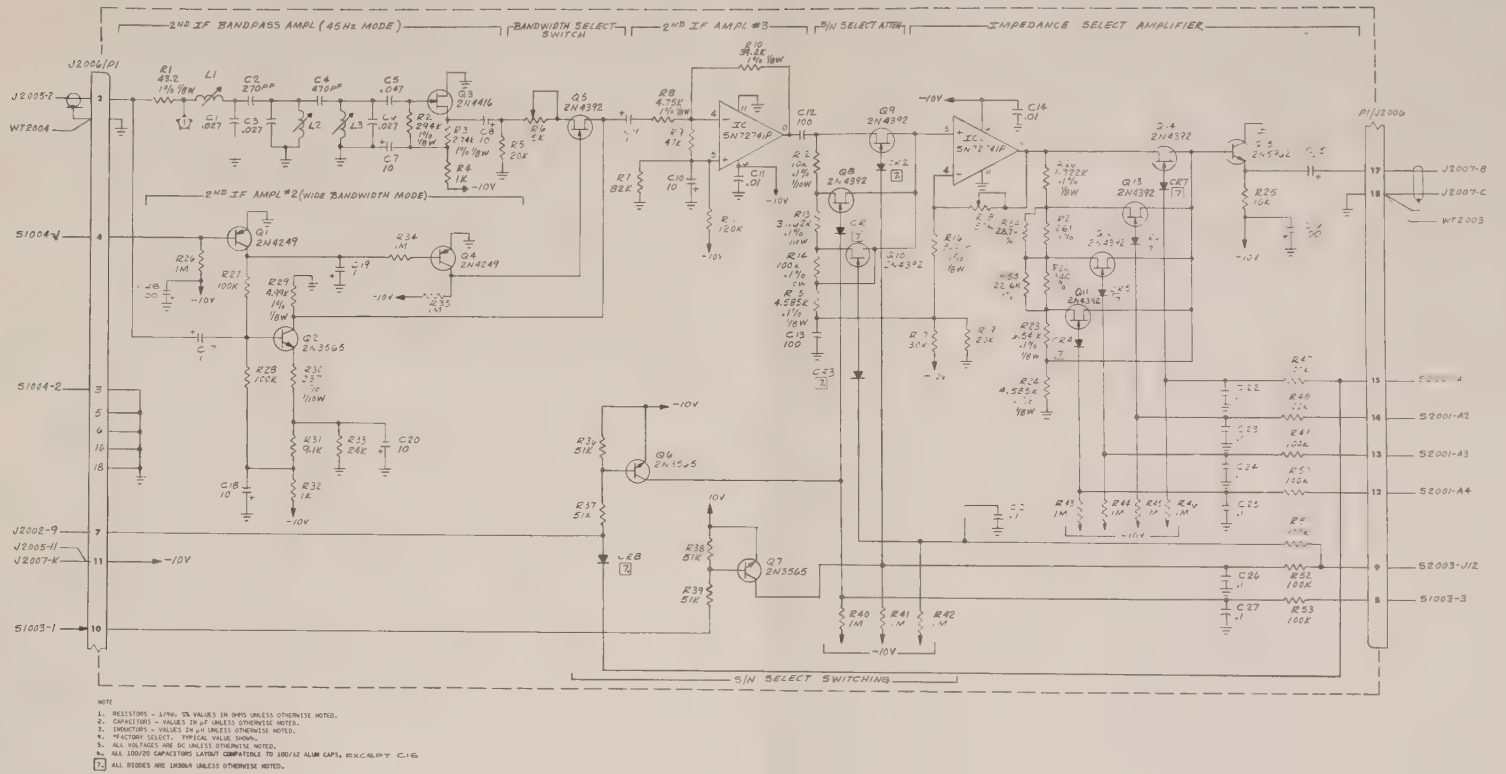
SECOND I. F. AND GAIN SWITCH. 2500 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| | RESISTORS | | | |
| R1 | MF, 43.2Ω, ±1%, 100 PPM, 1/8W | 1075-0069 | Dale | MFF 1/8 T1 |
| R2 | MF, 294k, ±1%, 100 PPM, 1/8W | 1075-0028 | Dale | MFF 1/8 T1 |
| R3 | MF, 2.74k, ±1%, 100 PPM, 1/8W | 1075-0071 | Dale | MFF 1/8 T1 |
| R4 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R5 | Comp, 20k, ±5%, 1/4W | 1066-2035 | Allen-Bradley | CB2035 |
| R6 | Pot, 5k, ±10%, 3/4W | 1215-0012 | Helitrim | 89WR |
| R7 | Comp, 82k, ±5%, 1/4W | 1066-8235 | Allen-Bradley | CB8235 |
| R8 | MF, 4.75k, ±1%, 100 PPM, 1/8W | 1075-0038 | Dale | MFF 1/8 T1 |
| R9 | Comp, 47k, ±5%, 1/4W | 1066-4735 | Allen-Bradley | CB4735 |
| R10 | MF, 39.2k, ±1%, 25 PPM, 1/10W | 1074-1032 | Dale | MFF 1/10 |
| R11 | Comp, 120k, ±5%, 1/4W | 1066-1245 | Allen-Bradley | CB1245 |
| R12 | MF, 10k, ±.1%, 25 PPM, 1/10W | 1074-0060 | Dale | MF 1/10 T9 |
| R13 | MF, 31.62k, ±.1%, 25 PPM, 1/10W | 1074-0063 | Dale | MF 1/10 T9 |
| R14 | MF, 100k, ±.1%, 25 PPM, 1/10W | 1074-0069 | Dale | MF 1/10 T9 |
| R15 | MF, 4.585k, ±.1%, 25 PPM, 1/8W | 1075-0118 | Dale | MFF 1/8 T9 |
| R16 | MF, 3.01k, ±1%, 100 PPM, 1/8W | 1075-0127 | Dale | MFF 1/8 RN55D |
| R17 | Comp, 30k, ±5%, 1/4W | 1066-3035 | Allen-Bradley | CB3035 |
| R18 | Pot, 50k, ±10%, 3/4W | 1215-0023 | Helitrim | 89WR |
| R19 | Comp, 20k, ±5%, 1/4W | 1066-2035 | Allen-Bradley | CB2035 |
| R20 | MF, 1.322k, ±.1%, 25 PPM, 1/8W | 1075-0120 | Dale | MFF 1/8 T9 |
| R21 | MF, 261 Ω, ±1%, 100 PPM, 1/10W | 1074-1054 | Dale | MF 1/10 |
| R22 | MF, 340 Ω, ±1%, 100 PPM, 1/10W | 1074-1055 | Dale | MF 1/10 |
| R23 | MF, 6.541k, ±.1%, 25 PPM, 1/8W | 1075-0119 | Dale | MFF 1/8 T9 |
| R24 | MF, 4.585k, ±.1%, 25 PPM, 1/8W | 1075-0118 | Dale | MFF 1/8 T9 |
| R25 | Comp, 10k, ±5%, 1/4W | 1066-1035 | Allen-Bradley | CB1035 |
| R26 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R27 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R28 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R29 | MF, 4.99k, ±1%, 100 PPM, 1/8W | 1075-0095 | Dale | MFF 1/8 T1 |
| R30 | MF, 237Ω, ±1%, 150 PPM, 1/10W | 1074-1041 | Dale | MF 1/10 T0 |
| R31 | Comp, 9.1k, ±5%, 1/4W | 1066-9125 | Allen-Bradley | CB9125 |
| R32 | Comp, 1k, ±5%, 1/4W | 1066-1025 | Allen-Bradley | CB1025 |
| R33 | Comp, 24k, ±5%, 1/4W | 1066-2435 | Allen-Bradley | CB2435 |
| R34 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R35 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R36 | Comp, 51k, ±5%, 1/4W | 1066-5135 | Allen-Bradley | CB5135 |
| R37 | Comp, 51k, ±5%, 1/4W | 1066-5135 | Allen-Bradley | CB5135 |
| R38 | Comp, 51k, ±5%, 1/4W | 1066-5135 | Allen-Bradley | CB5135 |
| R39 | Comp, 51k, ±5%, 1/4W | 1066-5135 | Allen-Bradley | CB5135 |
| R40 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R41 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R42 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R43 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R44 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R45 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R46 | Comp, 1MΩ, ±5%, 1/4W | 1066-1055 | Allen-Bradley | CB1055 |
| R47 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R48 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R49 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R50 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R51 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R52 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R53 | Comp, 100k, ±5%, 1/4W | 1066-1045 | Allen-Bradley | CB1045 |
| R54 | MF, 28.7k, ±1%, 100 PPM, 1/10W | 1074-1057 | Dale | MF 1/10 |
| R55 | MF, 22.6k, ±1%, 100 PPM, 1/10W | 1074-1056 | Dale | MF 1/10 |

SECOND I. F. AND GAIN SWITCH. 2500 (cont.)

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| | TRANSISTORS | | | |
| Q1 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q2 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q3 | J-FET, N-Chan, 2N4416 | 1272-0048 | Teledyne | 2N4416 |
| Q4 | Si, PNP, 2N4249 | 1272-0024 | Fairchild | 2N4249 |
| Q5 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q6 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q7 | Si, NPN, 2N3565 | 1272-0017 | Fairchild | 2N3565 |
| Q8 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q9 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q10 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q11 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q12 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q13 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q14 | J-FET, N-Chan, 2N4392 | 1272-0054 | Teledyne | 2N4392 |
| Q15 | Si, NPN, 2N5962 | 1272-0059 | Fairchild | 2N5962 |





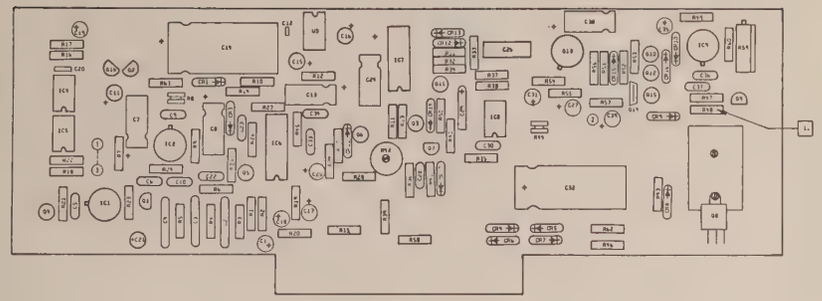

5601**0053**2

Figure 3-8. Second I. F. and Gain Switch. 2500

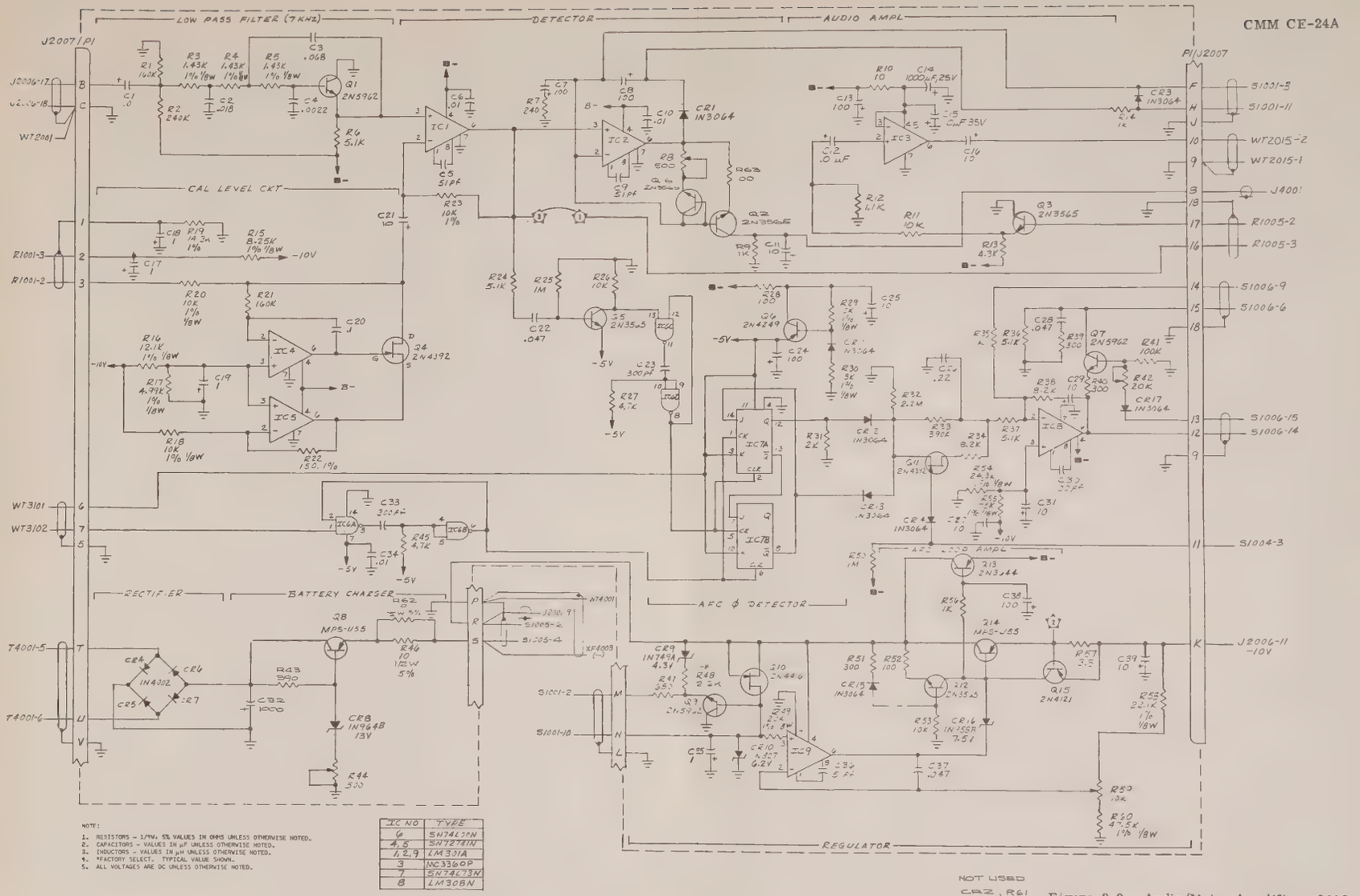
| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2600 | PCB ASSY - AUDIO/METER | 7001-0251 | CUSHMAN | CE-24A |
| | PRINTED CIRCUIT BOARD | 1780-0479 | CUSHMAN | |
| | **CAPACITOR** | | | |
| C 1 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 2 | CAP-.018UF 10% 100V RDL POLYESTER | 1008-0008 | SPRAGUE | 225P18391WD3 |
| C 3 | CAP-.068UF 10% 100V RDL POLYESTER | 1008-0036 | SPRAGUE | 225P68391WA3 |
| C 4 | CAP-.0022UF 10% 100V RDL POLYESTER | 1008-0020 | SPRAGUE | 225P22291WA3 |
| C 5 | CAP-51PF 5% 500V DIP MICA | 1002-0045 | ELMENCO | DM15-E-510J |
| C 6 | CAP-.01UF +80-20% 25V Y5U CER DISC | 1005-0013 | ERIE | 5835-512-Y5U-103Z |
| C 7 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 8 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 9 | CAP-51PF 5% 500V DIP MICA | 1002-0045 | ELMENCO | DM15-E-510J |
| C 10 | CAP-.01UF +80-20% 25V Y5U CER DISC | 1005-0013 | ERIE | 5835-512-Y5U-103Z |
| C 11 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 12 | CAP-.01UF 20% 100V Y5P MINTR CER WHT | 1005-0100 | ERIE | 8121-100-651-103M |
| C 13 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 14 | CAP-1000UF +50-10% 25V ELCTLT | 1014-0006 | ILLINOIS | 108TTA025A |
| C 15 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 16 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 17 | CAP-1UF 20% 50V RDL TANT | 1011-0013 | KEMET | T368A105M050AS |
| C 18 | CAP-1UF 20% 50V RDL TANT | 1011-0013 | KEMET | T368A105M050AS |
| C 19 | CAP-1UF 20% 50V RDL TANT | 1011-0013 | KEMET | T368A105M050AS |
| C 20 | CAP-.1UF 10% 100V MLD CER | 1005-0064 | AEROVOX | CK06BX104K |
| C 21 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 22 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 23 | CAP-300PF 5% 500V DIP MICA | 1002-0059 | ELMENCO | DM15-F-301J |
| C 24 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 25 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 26 | CAP-.22UF 10% 100V RDL MET-MYLAR | 1008-0091 | ELECTROCUBE | 232A1B224K |
| C 27 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 28 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 29 | CAP-10UF 10% 20V AXL TANT | 1011-0007 | KEMET | T310B106K020AS |
| C 30 | CAP-100PF 5% 500V DIP MICA | 1002-0011 | ELMENCO | DM15-F-101J |
| C 31 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 32 | CAP-1000UF +50-10% 35V AXL ELCTLT | 1013-0027 | NIPPON CHEMICON | CE02W35V |
| C 33 | CAP-300PF 5% 500V DIP MICA | 1002-0059 | ELMENCO | DM15-F-301J |
| C 34 | CAP-.01UF +80-20% 25V Y5U CER DISC | 1005-0013 | ERIE | 5835-512-Y5U-103Z |
| C 35 | CAP-1UF 20% 50V RDL TANT | 1011-0013 | KEMET | T368A105M050AS |
| C 36 | CAP-51PF 5% 500V DIP MICA | 1002-0045 | ELMENCO | DM15-E-510J |
| C 37 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 38 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 39 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| | **DIODE** | | | |
| CR 1 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 3 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 4 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 5 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 6 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 7 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 8 | DIO-1N964B SI ZENER D07 13V 5% .4W | 1281-0070 | MOTOROLA | 1N964B |
| CR 9 | DIO-1N749A SI ZENER D07 4.3V 5% .4W | 1281-0034 | MOTOROLA | 1N749A |
| CR 10 | DIO-1N827 SI ZENER D07 6.2V 5% .4W TC | 1281-0038 | | |
| CR 11 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 12 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 13 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| CR 14 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 15 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 16 | DIO-1N958B SI ZENER D07 7.5V 5% .4W | 1281-0071 | MOTOROLA | 1N958B |
| CR 17 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| | **TRANSISTOR** | | | |
| Q 1 | XSTR-2N5962 NPN SI T092 LOW PWR | 1272-0059 | FAIRCHILD | 2N5962 |
| Q 2 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 3 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 4 | XSTR-2N4392 SI T018 J-FET N-CHAN | 1272-0054 | TELEDYNE | 2N4392 |
| Q 5 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 6 | XSTR-2N4249 PNP SI R124B LOW PWR | 1272-0024 | CARTER SEMI | 2N4249 |
| Q 7 | XSTR-2N5962 NPN SI T092 LOW PWR | 1272-0059 | FAIRCHILD | 2N5962 |
| Q 8 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 9 | XSTR-2N5962 NPN SI T092 LOW PWR | 1272-0059 | FAIRCHILD | 2N5962 |
| Q 10 | XSTR-2N4416 SI TO 72 J-FET N-CHAN | 1272-0048 | INTERSIL | 2N4416 |
| Q 11 | XSTR-2N4392 SI T018 J-FET N-CHAN | 1272-0054 | TELEDYNE | 2N4392 |
| Q 12 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 13 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 14 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 15 | XSTR-2N4121 PNP SI R110 LOW PWR/SW | 1272-0023 | FAIRCHILD | PN4121 |
| Q 16 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| | **RESISTOR** | | | |
| R 1 | RES-160K 5% 1/4W CC | 1066-1645 | ALLEN BRADLEY | CB1645 |
| R 2 | RES-240K 5% 1/4W CC | 1066-2445 | ALLEN BRADLEY | CB2445 |
| R 3 | RES-1.43K 1% 100PPM FILM | 1075-0021 | CAT.LIST | 55-100 |
| R 4 | RES-1.43K 1% 100PPM FILM | 1075-0021 | CAT.LIST | 55-100 |
| R 5 | RES-1.43K 1% 100PPM FILM | 1075-0021 | CAT.LIST | 55-100 |
| R 6 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 7 | RES-240 OHM 5% 1/4W CC | 1066-2415 | ALLEN BRADLEY | CB2415 |
| R 8 | POT-500 OHM 20% 1/4W 1T CC TRMR | 1215-0026 | CTS | X201R501B |
| R 9 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 10 | RES-10 OHM 5% 1/4W CC | 1066-1005 | ALLEN BRADLEY | CB1005 |
| R 11 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |
| R 12 | RES-1.1K 5% 1/4W CC | 1066-1125 | ALLEN BRADLEY | CB1125 |
| R 13 | RES-4.3K 5% 1/4W CC | 1066-4325 | ALLEN BRADLEY | CB 4325 |
| R 14 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 15 | RES-8.25K 1% 100PPM FILM | 1075-0014 | CAT.LIST | 55-100 |
| R 16 | RES-12.1K 1% 100PPM FILM | 1075-0011 | CAT.LIST | 55-100 |
| R 17 | RES-4.99K 1% 100PPM FILM | 1075-0095 | CAT.LIST | 55-100 |
| R 18 | RES-10K 1% 100PPM FILM | 1075-0009 | CAT.LIST | 55-100 |
| R 19 | RES-14.3K 1% 100PPM FILM | 1074-0113 | CAT.LIST | 55-100 |
| R 20 | RES-10K 1% 100PPM FILM | 1075-0009 | CAT.LIST | 55-100 |
| R 21 | RES-160K 5% 1/4W CC | 1066-1645 | ALLEN BRADLEY | CB1645 |
| R 22 | RES-150 OHM 1% 100PPM FILM | 1075-0125 | CAT. LIST | 55-100 |
| R 23 | RES-10K 1% 100PPM FILM | 1075-0009 | CAT.LIST | 55-100 |
| R 24 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 25 | RES-1MEG 5% 1/4W CC | 1066-1055 | OHMITE | G.H. ONLY |
| R 26 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |
| R 27 | RES-4.7K 5% 1/4W CC | 1066-4725 | ALLEN BRADLEY | CB 4725 |
| R 28 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 29 | RES-10K 1% 100PPM FILM | 1075-0009 | CAT.LIST | 55-100 |
| R 30 | RES-13K 1% 100PPM FILM | 1075-0128 | CAT. LIST | 55-100 |
| R 31 | RES-2K 5% 1/4W CC | 1066-2025 | ALLEN BRADLEY | CB2025 |
| R 32 | RES-2.2MEG 5% 1/4W CC | 1066-2255 | ALLEN BRADLEY | CB2255 |

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R 33 | RES-390K 5% 1/4W CC | 1066-3945 | ALLEN BRADLEY | CB 3945 |
| R 34 | RES-8.2K 5% 1/4W CC | 1066-8225 | ALLEN BRADLEY | CB 8225 |
| R 35 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 36 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 37 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 38 | RES-8.2K 5% 1/4W CC | 1066-8225 | ALLEN BRADLEY | CB 8225 |
| R 39 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 40 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 41 | RES-100K 5% 1/4W CC | 1066-1045 | ALLEN BRADLEY | CB1045 |
| R 42 | POT-20K 20% 1/2W 1T CERMET TRMR | 1215-0044 | BECKMAN | 91AR20K |
| R 43 | RES-390 OHM 5% 1/4W CC | 1066-3915 | ALLEN BRADLEY | CB 3915 |
| R 44 | POT-500 OHM 20% 1/4W 1T CC TRMR | 1215-0026 | CTS | X201R501B |
| R 45 | RES-4.7K 5% 1/4W CC | 1066-4725 | ALLEN BRADLEY | CB 4725 |
| R 46 | RES-10 OHM 5% 1/2W CC | 1067-1005 | ALLEN BRADLEY | EB 1005 |
| R 47 | RES-680 OHM 5% 1/4W CC | 1066-6815 | ALLEN BRADLEY | CB 6815 |
| R 48 | RES-2.2K 5% 1/4W CC | 1066-2225 | ALLEN BRADLEY | CB2225 |
| R 49 | RES-20K 1% 100PPM FILM | 1075-0096 | CAT.LIST | 55-100 |
| R 50 | RES-1MEG 5% 1/4W CC | 1066-1055 | OHMITE | G.H. ONLY |
| R 51 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 52 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 53 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |
| R 54 | RES-24.3K 1% 100PPM FILM | 1075-0097 | CAT.LIST | 55-100 |
| R 55 | RES-75K 1% 100PPM FILM | 1075-0135 | CAT. LIST | 55-100 |
| R 56 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 57 | RES-3.3 OHM 5% 1/4W CC | 1066-0006 | ALLEN BRADLEY | CB33G5 |
| R 58 | RES-22.1K 1% 100PPM FILM | 1075-0012 | CAT.LIST | 55-100 |
| R 59 | POT-10K 10% 3/4W 15T CERMET TRMR | 1215-0014 | HELITRIM | 89WR10K |
| R 60 | RES-47.5K 1% 100PPM FILM | 1075-0076 | CAT.LIST | 55-100 |
| R 62 | RES-10 OHM 5% 1/2W CC | 1067-1005 | ALLEN BRADLEY | EB 1005 |
| R 63 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| | **INTEGRATED CIRCUIT** | | | |
| U 1 | IC-LM301A OP AMP | 2025-0032 | NATIONAL | LM301AH |
| U 2 | IC-LM301A OP AMP | 2025-0032 | NATIONAL | LM301AH |
| U 3 | IC-380 8 PIN DIP 2.5W AUDIO AMPL | 2025-0256 | NATIONAL | LM380N-8 |
| U 4 | IC-UA741CP | 2025-0067 | TI | UA741CP |
| U 5 | IC-UA741CP | 2025-0067 | TI | UA741CP |
| U 6 | IC-SN74LS00N TTL NAND GATES | 2025-0114 | TI | SN74LS00N |
| U 7 | IC-SN74LS73N DUAL J-K FLIP FLOP | 2025-0110 | TI | SN74LS73N |
| U 8 | IC-LM308N OP AMPL 8 PIN | 2025-0070 | NATIONAL | LM308N |
| U 9 | IC-LM301A OP AMP | 2025-0032 | NATIONAL | LM301AH |



1. FACTORY SELECT VALUE.



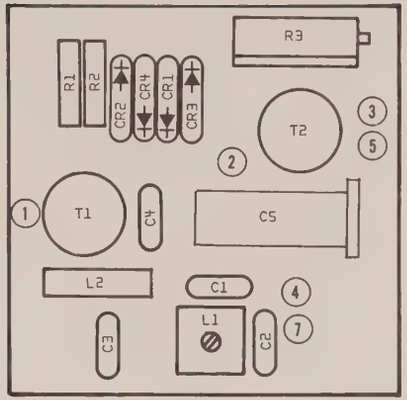

| IC NO | TYPE |
|---|---|
| 6 | SN74L20N |
| 4,5 | SN72741N |
| 1,2,9 | LM331A |
| 3 | MC3360P |
| 7 | SN74L13N |
| 8 | LM380N |

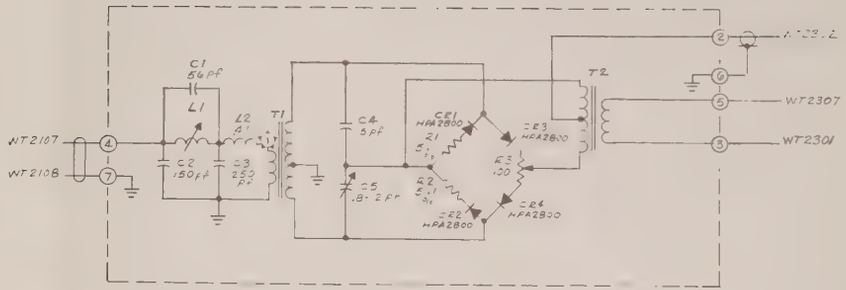
NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 3-9. Audio/Meter Amplifier 2600

FIRST MIXER. 2700

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 2700 | First Mixer | 7001-0256 | Cushman | |
| | P. C. Board | 1780-0484 | Cushman | |
| | CAPACITORS | | | |
| C1 | Mica, 56pF, ±5%, 500V | 1002-0019 | Elmenco | DM15-E-560J |
| C2 | Mica, 150pF, ±5%, 500V | 1002-0021 | Elmenco | DM15-F-151J |
| C3 | Mica, 250pF, ±5%, 500V | 1002-0061 | Elmenco | DM15-F-251J |
| C4 | Mica, 5pF, ±.5pF, 500V | 1002-0028 | Elmenco | DM15-C-050D |
| C5 | Trim, .8-12pF, 750V | 1001-0007 | JFD | VC-316WY |
| | DIODES | | | |
| CR1 | Hot Carrier, HPA2800 | 1283-0001 | HPA | 5082-2800 |
| CR2 | Hot Carrier, HPA2800 | 1283-0001 | HPA | 5082-2800 |
| CR3 | Hot Carrier, HPA2800 | 1283-0001 | HPA | 5082-2800 |
| CR4 | Hot Carrier, HPA2800 | 1283-0001 | HPA | 5082-2800 |
| | INDUCTORS | | | |
| L1 | Variable | 1596-0081 | Cushman | |
| L2 | RF, Choke, .47μH, ±20% | 1585-0031 | Delevan | 1537-06 |
| | RESISTORS | | | |
| R1 | MF, 51.1Ω, ±1%, 150PPM, 1/8W | 1075-0077 | Dale | MFF 1/8 T-0 |
| R2 | MF, 51.1Ω, ±1%, 150PPM, 1/8W | 1075-0077 | Dale | MFF 1/8 T-0 |
| R3 | Pot, 100Ω, ±10%, 3/4W | 1215-0010 | Helitrim | 89WR |
| | TRANSFORMERS | | | |
| T1 | Toroid, Trifilar | 1579-0017 | Cushman | |
| T2 | Toroid, Trifilar | 1579-0017 | Cushman | |




NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

5601-0053

Figure 3-10. First Mixer. 2700

LOGIC/DISPLAY CONTAINER ASSEMBLY. 3000

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 3000 | Logic/Display Container Assembly | 7046-0022 | Cushman | |
| | CONNECTORS | | | |
| P1 | 2 pin Plug, Non-locking, Mini | 2535-0060 | Molex | 09-50-7021 |
| P2 | 3 pin Plug, Non-locking, Mini | 2535-0059 | Molex | 09-50-7031 |
| P3 | 3 pin Plug, Non-locking, Mini | 2535-0059 | Molex | 09-50-7031 |
| P4 | 3 pin Plug, Non-locking, Mini | 2535-0059 | Molex | 09-50-7031 |
| P5 | 2 pin Plug, Non-locking, Mini | 2535-0060 | Molex | 09-50-7021 |
| P6 | 2 pin Plug, Non-locking, Mini | 2535-0060 | Molex | 09-50-7021 |
| P7 | 3 pin Plug, Non-locking, Mini | 2535-0059 | Molex | 09-50-7031 |
| P8 | 3 pin Plug, Non-locking, Mini | 2535-0059 | Molex | 09-50-7031 |
| | Pins, Mini female, for P1-P8 | 4153-0007 | Molex | 2578-TL |
| | Pins, square female, on wire | 4153-0011 | Malco | 122-0192-019 |
| | TRANSISTORS | | | |
| Q1 | Ge, PNP, 2N1544 | 1272-0096 | Motorola | 2N1544 |
| Q2 | Si, NPN, 2N3054 | 1271-0001 | RCA | 2N3054 |
| | SWITCH | | | |
| S1 | DPDT, Flat Handle, Toggle | 1850-0018 | C&K | 7203PY1ZQE |

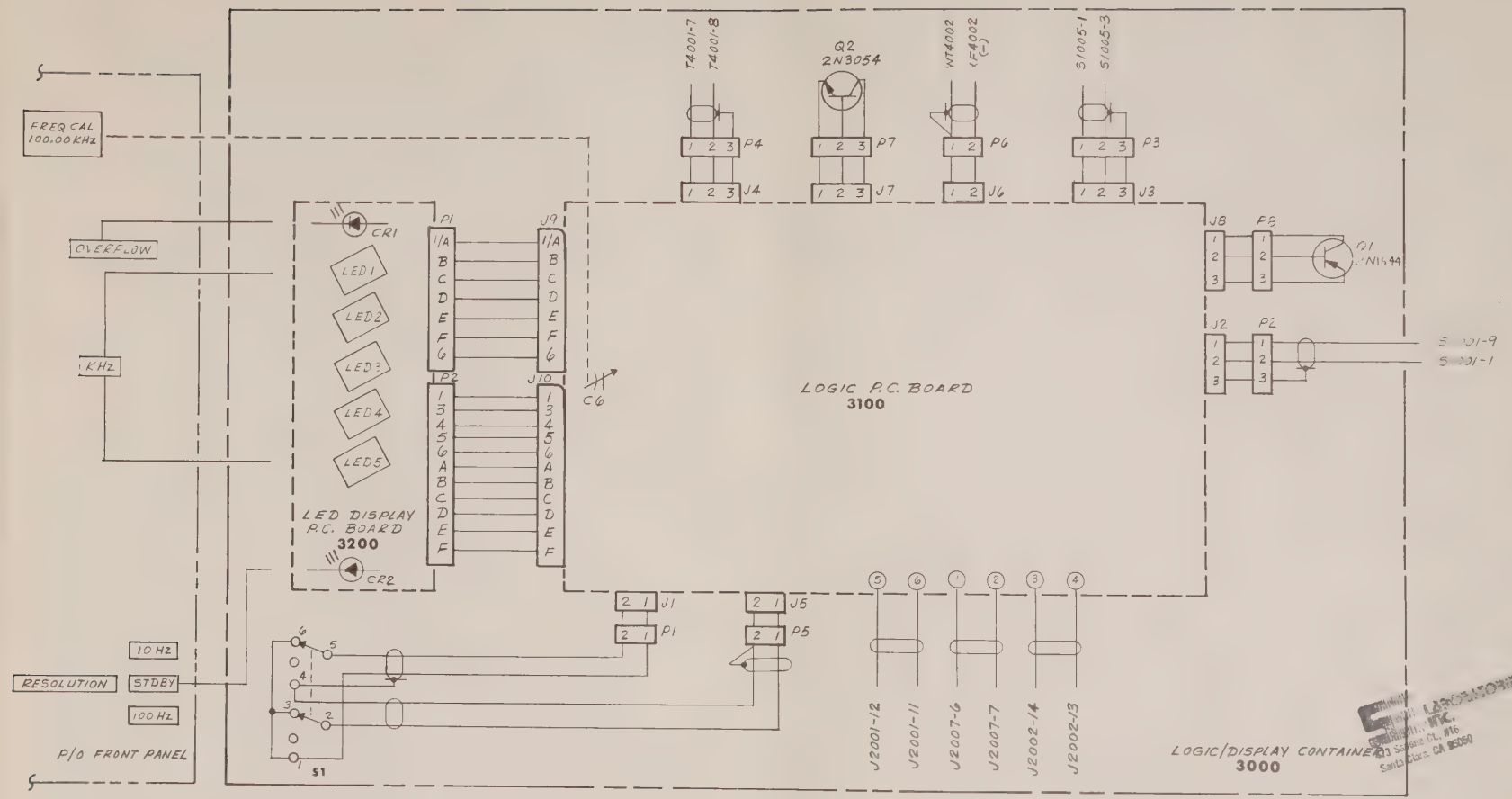


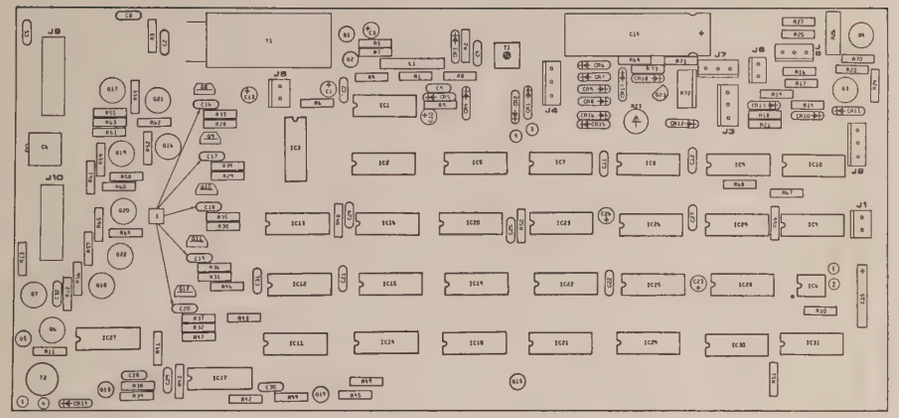

Figure 3-11. Logic Container Interconnection Diagram, 3000

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 3100 | PCB ASSY - LOGIC | 7001-0452 | CUSHMAN | CE-24A |
| | PRINTED CIRCUIT BOARD | 1780-0515 | CUSHMAN | |
| | **CAPACITOR** | | | |
| C 1 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 2 | CAP-1000PF 5% 100V DIP MICA | 1002-0015 | ELMENCO | DM15-F-102J |
| C 3 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 4 | CAP-1000PF 5% 100V DIP MICA | 1002-0015 | ELMENCO | DM15-F-102J |
| C 5 | CAP-15PF 10% 500V P100 CER DISC | 1005-0103 | RMC | CGP100 |
| C 6 | CAP-2-8PF 350V NPO H MT CER TRMR | 1001-0010 | ERIE | 538-006A (2-8) |
| C 7 | CAP-.01UF +80-20% 25V Y5U CER DISC | 1005-0013 | ERIE | 5835-512-Y5U-103Z |
| C 8 | CAP-56PF 5% 500V DIP MICA | 1002-0019 | ELMENCO | DM15-E-560J |
| C 9 | CAP-.1UF 20% 50V Z5U CER DISC | 1005-0044 | SPRAGUE | 5CZ5U104X0050C5 |
| C 10 | CAP-1UF 20% 50V RDL TANT | 1011-0013 | KEMET | T368A105M050AS |
| C 11 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 12 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 13 | CAP-100UF 20% 20V RDL TANT | 1011-0010 | KEMET | T362D107M020AS |
| C 14 | CAP-1000UF +50-10% 25V ELCTLT | 1014-0006 | ILLINOIS | 108TTA025A |
| C 15 | CAP-100UF +75-10% 16V AXL ELCTLT | 1013-0011 | NICHICON | 16ELA100 |
| C 21 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 22 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 23 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 24 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 25 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 26 | CAP-10UF 20% 35V RDL TANT | 1011-0006 | MATSUO | 221L3502106M3 |
| C 27 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| C 28 | CAP-.01UF +80-20% 25V Y5U CER DISC | 1005-0013 | ERIE | 5835-512-Y5U-103Z |
| C 29 | CAP-680PF 5% 300V DIP MICA | 1002-0022 | ELMENCO | DM15-F-681J |
| C 30 | CAP-.0039UF GMV 1KV Z5U CER DISC | 1005-0106 | SPRAGUE | 5HK-D39 |
| C 31 | CAP-330PF 5% 500V DIP MICA | 1002-0032 | ELMENCO | DM15-F-331J |
| C 32 | CAP-.05UF +80-20% 25V Y5U CER DISC | 1005-0014 | ERIE | 5835-514-Y5U-503Z |
| | **DIODE** | | | |
| CR 1 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 2 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 3 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 4 | DIO-G633 GE SIG D07 1.5PF 40PRV | 1282-0005 | ITT | C/E DWG G633 |
| CR 5 | DIO-G633 GE SIG D07 1.5PF 40PRV | 1282-0005 | ITT | C/E DWG G633 |
| CR 6 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 7 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 8 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 9 | DIO-1N4002 SI RECT A23F 100PRV 1A | 1281-0023 | ITT | 1N4002 |
| CR 10 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 11 | DIO-1N749A SI ZENER D07 4.3V 5% .4W | 1281-0034 | MOTOROLA | 1N749A |
| CR 12 | DIO-1N958B SI ZENER D07 7.5V 5% .4W | 1281-0071 | MOTOROLA | 1N958B |
| CR 13 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 14 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 15 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 16 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 17 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| CR 18 | DIO-1N3064 SI SW D07/D035 75PRV .25W | 1281-0013 | FAIRCHILD | 1N3064 |
| | **CONNECTOR** | | | |
| J 1 | CONN-2 PIN RECEPT. | 2535-0061 | MOLEX | 09-60-1021 |
| J 2 | CONN-3 PIN RECEPT. | 2535-0062 | MOLEX | 09-60-1031 |
| J 3 | CONN-3 PIN RECEPT. | 2535-0062 | MOLEX | 09-60-1031 |
| J 4 | CONN-3 PIN RECEPT. | 2535-0062 | MOLEX | 09-60-1031 |

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| J 5 | CONN-2 PIN RECEPT. | 2535-0061 | MOLEX | 09-60-1021 |
| J 6 | CONN-2 PIN RECEPT. | 2535-0061 | MOLEX | 09-60-1021 |
| J 7 | CONN-3 PIN RECEPT. | 2535-0062 | MOLEX | 09-60-1031 |
| J 8 | CONN-3 PIN RECEPT. | 2535-0062 | MOLEX | 09-60-1031 |
| J 9 | CONN-12 CONTACT DOUBLE ROW | 2535-0063 | VIKING | 2VK6D/2-12 |
| J 10 | CONN-12 CONTACT DOUBLE ROW | 2535-0063 | VIKING | 2VK6D/2-12 |
| | **INDUCTOR** | | | |
| L 1 | CH-4700UH 5% RF MLD AXL .19DX.44L | 1585-0006 | DELEVAN | 2500-60 |
| | **TRANSISTOR** | | | |
| Q 1 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 2 | XSTR-2N3565 NPN SI R110 LOW PWR | 1272-0017 | FAIRCHILD | 2N3565 |
| Q 3 | XSTR-2N3567 NPN SI TO 105 LOW PWR | 1272-0014 | | |
| Q 4 | XSTR-2N3567 NPN SI TO 105 LOW PWR | 1272-0014 | | |
| Q 5 | XSTR-2N4275 NPN SI R110 LOW PWR/SW | 1272-0016 | FAIRCHILD | 2N4275 |
| Q 6 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 7 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 8 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 9 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 10 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 11 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 12 | XSTR-MPS-U55 PNP SI B18 HIGH PWR | 1272-0074 | | |
| Q 13 | XSTR-2N4275 NPN SI R110 LOW PWR/SW | 1272-0016 | FAIRCHILD | 2N4275 |
| Q 14 | XSTR-2N4275 NPN SI R110 LOW PWR/SW | 1272-0016 | FAIRCHILD | 2N4275 |
| Q 15 | XSTR-2N4275 NPN SI R110 LOW PWR/SW | 1272-0016 | FAIRCHILD | 2N4275 |
| Q 16 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 17 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 18 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 19 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 20 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 21 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 22 | XSTR-2N3644 PNP SI R110A LOW PWR/SW | 1272-0040 | FAIRCHILD | 2N3644 |
| Q 23 | XSTR-2N4249 PNP SI R124B LOW PWR | 1272-0024 | CARTER SEMI | 2N4249 |
| | **RESISTOR** | | | |
| R 1 | RES-18K 5% 1/4W CC | 1066-1835 | ALLEN BRADLEY | CB1835 |
| R 2 | RES-3K 5% 1/4W CC | 1066-3025 | ALLEN BRADLEY | CB3025 |
| R 3 | RES-1.5K 5% 1/4W CC | 1066-1525 | ALLEN BRADLEY | CB1525 |
| P 4 | RES-1.5K 5% 1/4W CC | 1066-1525 | ALLEN BRADLEY | CB1525 |
| R 5 | RES-240 OHM 5% 1/4W CC | 1066-2415 | ALLEN BRADLEY | CB2415 |
| R 6 | RES-20K 5% 1/4W CC | 1066-2035 | ALLEN BRADLEY | CB2035 |
| R 7 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 8 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |
| R 9 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 10 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 11 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 12 | RES-91 OHM 5% 1/4W CC | 1066-9105 | ALLEN BRADLEY | CB 9105 |
| R 13 | RES-91 OHM 5% 1/4W CC | 1066-9105 | ALLEN BRADLEY | CB 9105 |
| R 14 | RES-680 OHM 5% 1/4W CC | 1066-6815 | ALLEN BRADLEY | CB 6815 |
| R 16 | RES-1 OHM 5% 1/2W CC | 1067-0001 | ALLEN BRADLEY | EB 0001 |
| R 17 | RES-1 OHM 5% 1/2W CC | 1067-0001 | ALLEN BRADLEY | EB 0001 |
| R 18 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 19 | RES-1 OHM 5% 1/2W CC | 1067-0001 | ALLEN BRADLEY | EB 0001 |
| R 20 | RES-200 OHM 5% 1/4W CC | 1066-2015 | ALLEN BRADLEY | CB2015 |
| R 21 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| R 23 | POT-100 OHM 20% 1/2W 1T CERMET TRMR | 1215-0054 | BECKMAN | 91AR100 |
| R 24 | RES-180 OHM 5% 1/4W CC | 1066-1815 | ALLEN BRADLEY | CB1815 |
| R 25 | RES-220 OHM 5% 1/4W CC | 1066-2215 | ALLEN BRADLEY | CB2215 |
| R 26 | POT-500 OHM 20% 1/4W 1T CC TRMR | 1215-0026 | CTS | X201R501B |
| R 27 | RES-3.3K 5% 1/4W CC | 1066-3325 | ALLEN BRADLEY | CB3325 |
| R 28 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 29 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 30 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 31 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 32 | RES-100 OHM 5% 1/4W CC | 1066-1015 | ALLEN BRADLEY | CB1015 |
| R 33 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 34 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 35 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 36 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 37 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 38 | RES-15K 5% 1/4W CC | 1066-1535 | ALLEN BRADLEY | CB1535 |
| R 39 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 40 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 41 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 42 | RES-470 OHM 5% 1/4W CC | 1066-4715 | ALLEN BRADLEY | CB 4715 |
| R 43 | RES-2.4K 5% 1/4W CC | 1066-2425 | ALLEN BRADLEY | CB2425 |
| R 44 | RES-2.4K 5% 1/4W CC | 1066-2425 | ALLEN BRADLEY | CB2425 |
| R 45 | RES-2K 5% 1/4W CC | 1066-2025 | ALLEN BRADLEY | CB2025 |
| R 46 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 47 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 48 | RES-2.4K 5% 1/4W CC | 1066-2425 | ALLEN BRADLEY | CB2425 |
| R 49 | RES-2.4K 5% 1/4W CC | 1066-2425 | ALLEN BRADLEY | CB2425 |
| R 50 | RES-2K 5% 1/4W CC | 1066-2025 | ALLEN BRADLEY | CB2025 |
| R 51 | RES-240 OHM 5% 1/4W CC | 1066-2415 | ALLEN BRADLEY | CB2415 |
| R 52 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 53 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 54 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 55 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 56 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 57 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 58 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 59 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 60 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 61 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 62 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 63 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 64 | RES-300 OHM 5% 1/4W CC | 1066-3015 | ALLEN BRADLEY | CB3015 |
| R 65 | RES-75 OHM 5% 1/4W CC | 1066-7505 | ALLEN BRADLEY | CB 7505 |
| R 66 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 67 | RES-5.1K 5% 1/4W CC | 1066-5125 | ALLEN BRADLEY | CB 5125 |
| R 68 | RES-10K 5% 1/4W CC | 1066-1035 | ALLEN BRADLEY | CB1035 |
| R 69 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| R 70 | RES-68 OHM 5% 1/4W CC | 1066-6805 | ALLEN BRADLEY | CB 6805 |
| R 71 | RES-51 OHM 5% 1/4W CC | 1066-5105 | ALLEN BRADLEY | CB 5105 |
| R 72 | POT-250 OHM 20% 1/4W 1T CC TRMR | 1215-0025 | CTS | X201R251B |
| R 73 | RES-1K 5% 1/4W CC | 1066-1025 | ALLEN BRADLEY | CB1025 |
| | **TRANSFORMER** | | | |
| T 1 | TRANSF-VARIABLE IF | 1597-0002 | | |
| T 2 | ASSY-TRIFILAR COIL | 1579-0017 | | |

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| | **INTEGRATED CIRUIT** | | | |
| U 1 | IC-SN74LS00N TTL NAND GATES | 2025-0114 | TI | SN74LS00N |
| U 2 | IC-74LS192 16 PIN DIP BCD-DEC UP/DWN | 2025-0226 | FAIRCHILD | 74LS192PC |
| U 3 | IC-SN74145N | 2025-0074 | TI | SN74145N |
| U 4 | IC-SN7404N HEX INVERTER | 2025-0048 | TI | SN7404N |
| U 5 | IC-SN74L90N DECADE COUNTER | 2025-0071 | NATIONAL | DM74LS90N |
| U 6 | IC-4N28 OPTOELECTRONIC COUPLERS | 2025-0073 | MOTOROLA | 4N28 |
| U 7 | IC-SN74L90N DECADE COUNTER | 2025-0071 | NATIONAL | DM74LS90N |
| U 8 | IC-SN74L90N DECADE COUNTER | 2025-0071 | NATIONAL | DM74LS90N |
| U 9 | IC-SN74LS73N DUAL J-K FLIP FLOP | 2025-0110 | TI | SN74LS73N |
| U 10 | IC-SN74L03N | 2025-0080 | TI | SN74LS03N |
| U 11 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 12 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 13 | IC-SN74196N | 2025-0016 | FAIRCHILD | 74196PC |
| U 14 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 15 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 16 | IC-SN7490N | 2025-0002 | TI | SN7490N |
| U 17 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 18 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 19 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 20 | IC-SN7490N | 2025-0002 | TI | SN7490N |
| U 21 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 22 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 23 | IC-SN74196N | 2025-0016 | FAIRCHILD | 74196PC |
| U 24 | IC-SN7400N TTL NAND GATES | 2025-0003 | TI | SN7400N |
| U 25 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 26 | IC-SN74196N | 2025-0016 | FAIRCHILD | 74196PC |
| U 27 | IC-74LS47 16PIN DIP BCD 7SEG DCDR/DRV | 2025-0218 | NATIONAL | DM74LS47N |
| U 28 | IC-SN74L75N | 2025-0076 | TI | SN74L75N |
| U 29 | IC-SN7490N | 2025-0002 | TI | SN7490N |
| U 30 | IC-SN7427N TRIPLE 3-INPUT POS-NOR GAT | 2025-0094 | TEXAS INSTRUMENTS | SN7427N |
| U 31 | IC-SN74LS00N TTL NAND GATES | 2025-0114 | TI | SN74LS00N |
| | **CRYSTAL** | | | |
| Y 1 | XTAL-100 KHZ METAL | 2035-0013 | BULOVA | C/E DWG |



1. INSTALLED IN CERTAIN UNITS DURING FINAL TEST.

5601-0053-3

CMM CE-24A

Figure 3-12. Logic, sheet 1 3100

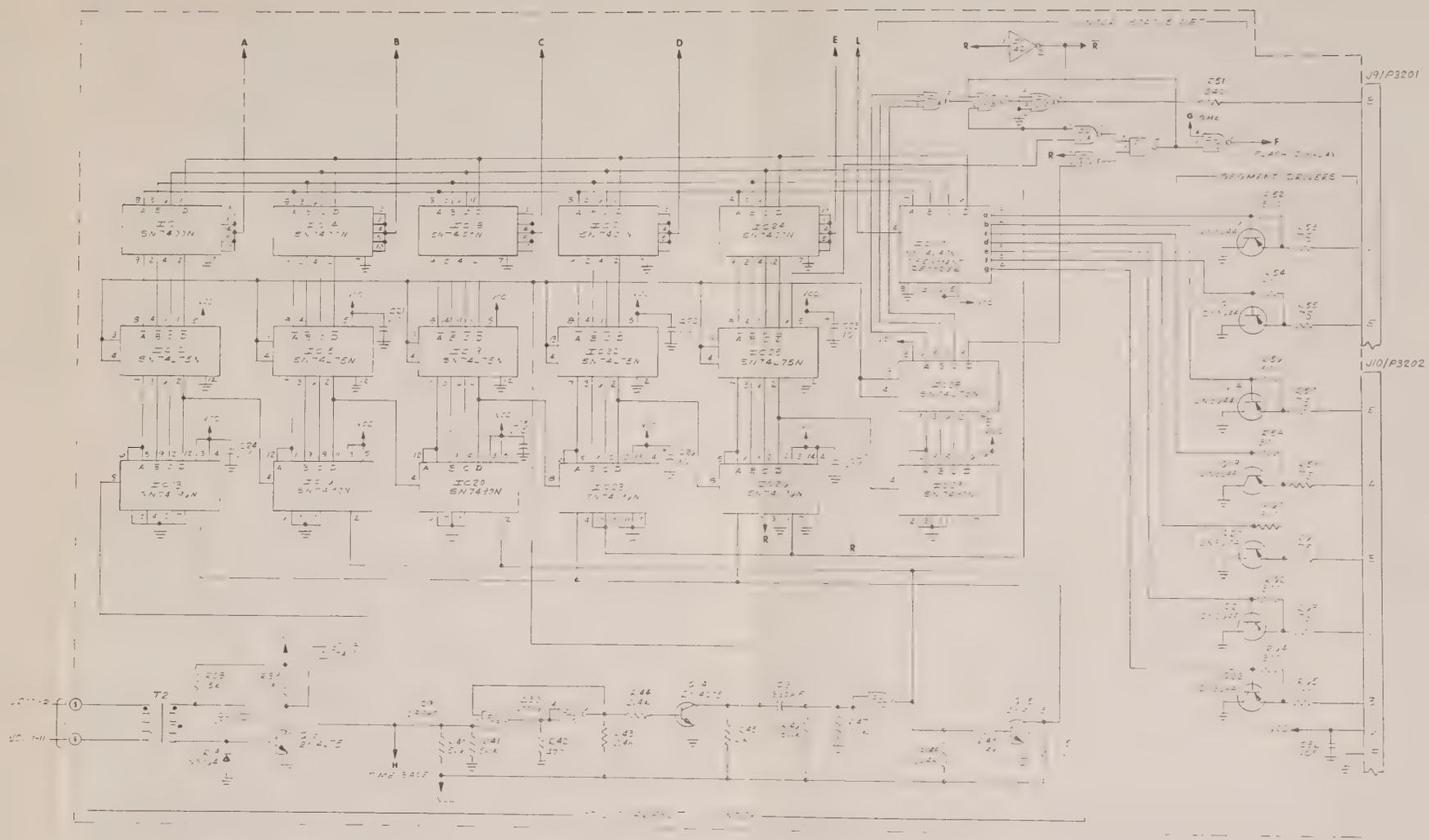
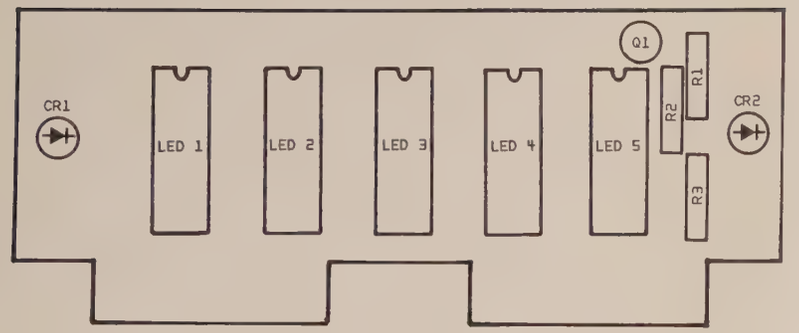


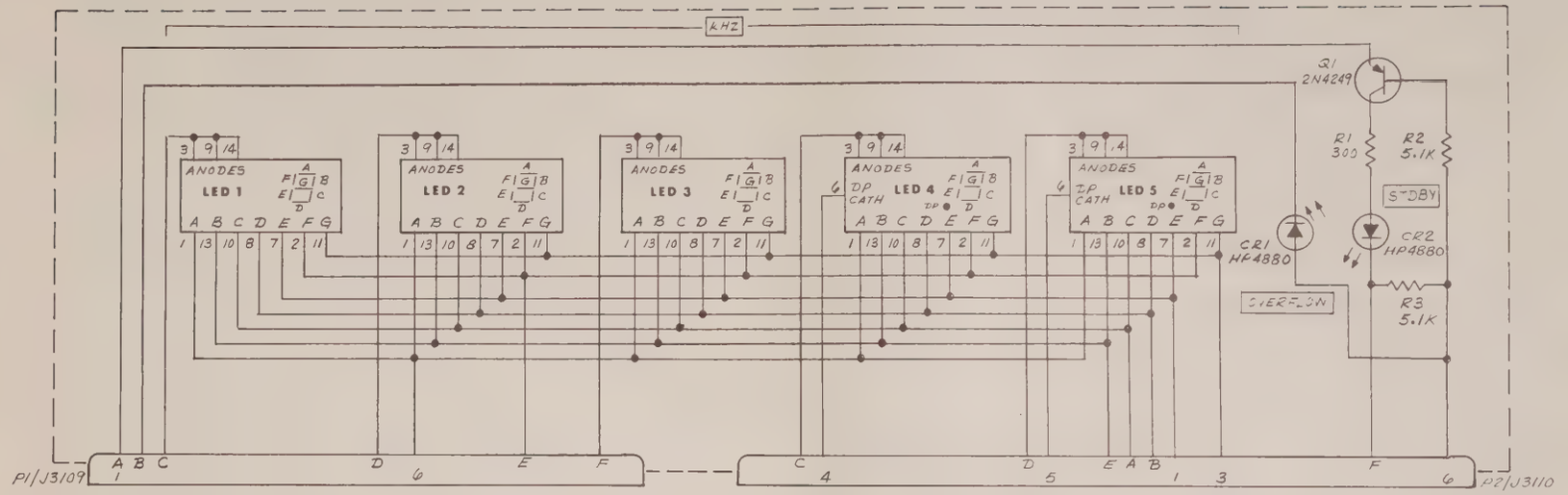

Figure 3-13. Logic, sheet 2 3100

5601 0053 3

L.E.D. DISPLAY. 3200

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 3200 | LED Display | 7001-0453 | Cushman | |
| | P.C. Board | 1780-0481 | Cushman | |
| | DIODES | | | |
| LED 1 | Alpha-Numeric Seq. Readout, HP7730 | 1281-0081 | HP | 5082-7730 |
| LED 2 | Alpha-Numeric Seq. Readout, HP7730 | 1281-0081 | HP | 5082-7730 |
| LED 3 | Alpha-Numeric Seq. Readout, HP7730 | 1281-0081 | HP | 5082-7730 |
| LED 4 | Alpha-Numeric Seq. Readout, HP7730 | 1281-0081 | HP | 5082-7730 |
| LED 5 | Alpha-Numeric Seq. Readout, HP7730 | 1281-0081 | HP | 5082-7730 |
| CR1 | Light Emitting Diffused, HP4880 | 1281-0069 | HP | 5082-4880 |
| CR2 | Light Emitting Diffused, HP4880 | 1281-0069 | HP | 5082-4880 |
| | RESISTORS | | | |
| R1 | Comp, 300Ω, ±5%, 1/4W | 1066-3015 | Allen-Bradley | CB3015 |
| R2 | Comp, 5.1k, ±5%, 1/4W | 1066-5125 | Allen-Bradley | CB5125 |
| R3 | Comp, 5.1k, ±5%, 1/4W | 1066-5125 | Allen-Bradley | CB5125 |
| | SOCKETS | | | |
| XCI1 | 14 Pin, Dual In-Line | 2606-0004 | Cinch | 133-51-02-003 |
| XCI2 | 14 Pin, Dual In-Line | 2606-0004 | Cinch | 133-51-02-003 |
| XCI3 | 14 Pin, Dual In-Line | 2606-0004 | Cinch | 133-51-02-003 |
| XCI4 | 14 Pin, Dual In-Line | 2606-0004 | Cinch | 133-51-02-003 |
| XCI5 | 14 Pin, Dual In-Line | 2606-0004 | Cinch | 133-51-02-003 |
| | TRANSISTORS | | | |
| Q1 | Si, PNP, 2N4249 | 1271-0024 | Fairchild | 2N4249 |




NOTE:

1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

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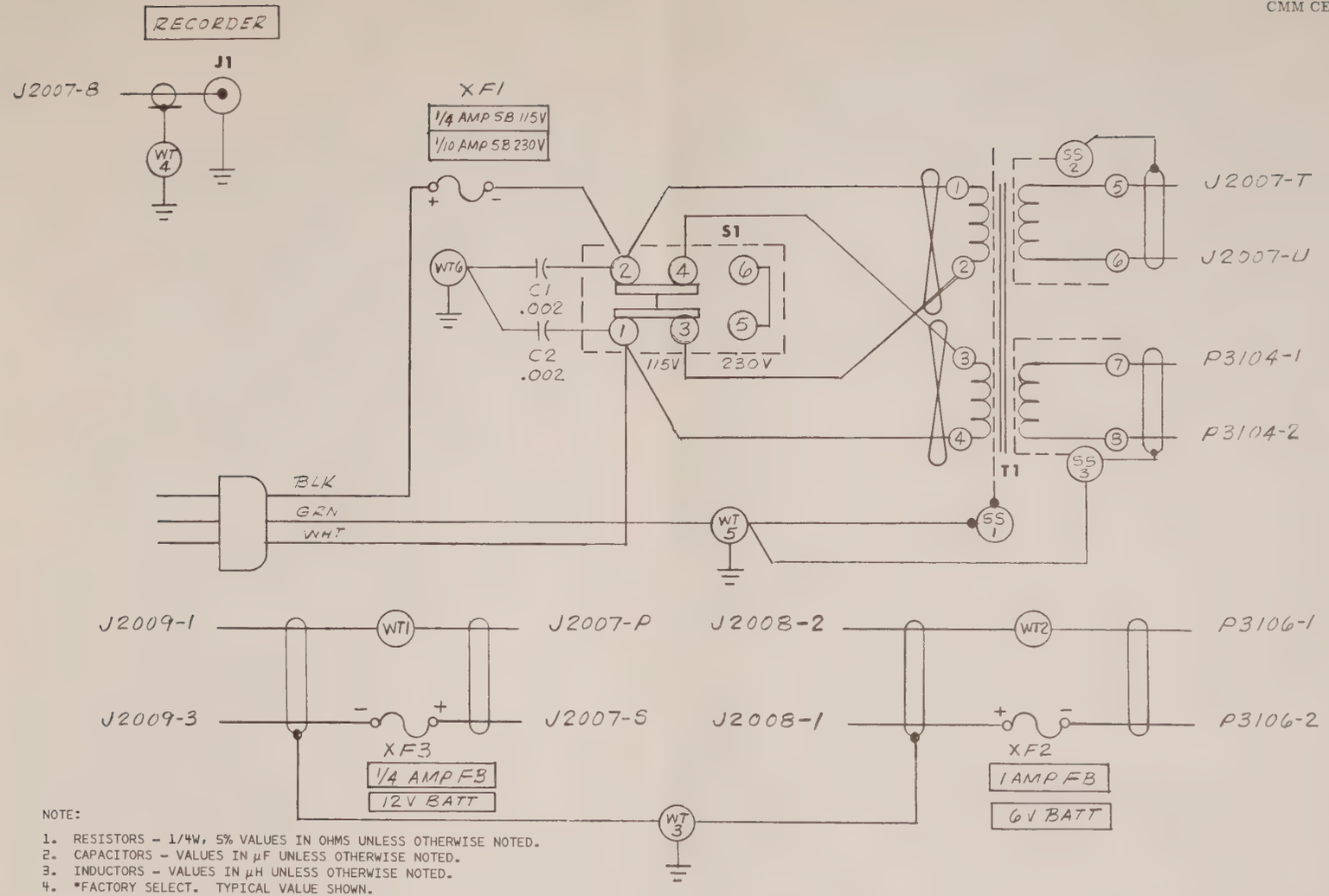
Figure 3-14. L. E. D. Display. 3200

REAR PANEL. 4000

| CKT. REF. | DESCRIPTION | CE STOCK NO. | MFR. | MFR. NO. |
|---|---|---|---|---|
| 4000 | Rear Panel Assembly | 7003-0085 | Cushman | |
| | CAPACITORS | | | |
| C1 | Cer, 2200pF, ±20%, 3KV | 1005-0098 | Erie | 818Y5 |
| C2 | Cer, 2200pF, ±20%, 3KV | 1005-0098 | Erie | 818Y5 |
| | CONNECTOR | | | |
| J1 | BNC, Bulkhead | 2536-0010 | Kings | KC79-35 |
| | FUSES | | | |
| F1 | 1/4 Amp/125V, Slow-Blow, 3AG | 1955-0013 | Littelfuse | 313.250 |
| F2 | 1 Amp/250V, Fast-Blow, 3AG | 1955-0003 | Littelfuse | 312.001 |
| F3 | 1/4 Amp/250V, Fast-Blow, 3AG | 1955-0015 | Littelfuse | 312.250 |
| XF1 | Fuseholder, Panel Mount, 3AG | 1965-0001 | Littelfuse | 342012AL |
| XF2 | Fuseholder, Panel Mount, 3AG | 1965-0001 | Littelfuse | 342012AL |
| XF3 | Fuseholder, Panel Mount, 3AG | 1965-0001 | Littelfuse | 342012AL |
| | SWITCH | | | |
| S1 | Slide, 115/230V | 1850-0012 | Switchcraft | 46256LFR |
| | TRANSFORMER | | | |
| T1 | Power | 1575-0024 | Cushman | |




NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

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Figure 3-15. Rear Panel Interconnection Diagram. 4000

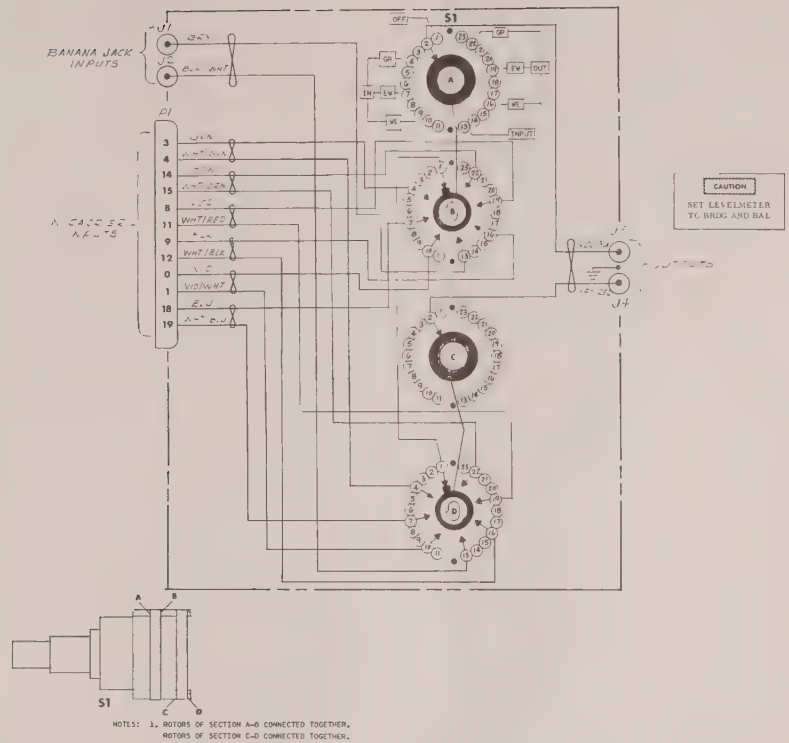


Figure 3-16. N-Carrier Adapter.

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